tomers' Appliances, and other articles for Dealer, Contractor, Jobber and Central-Station Man

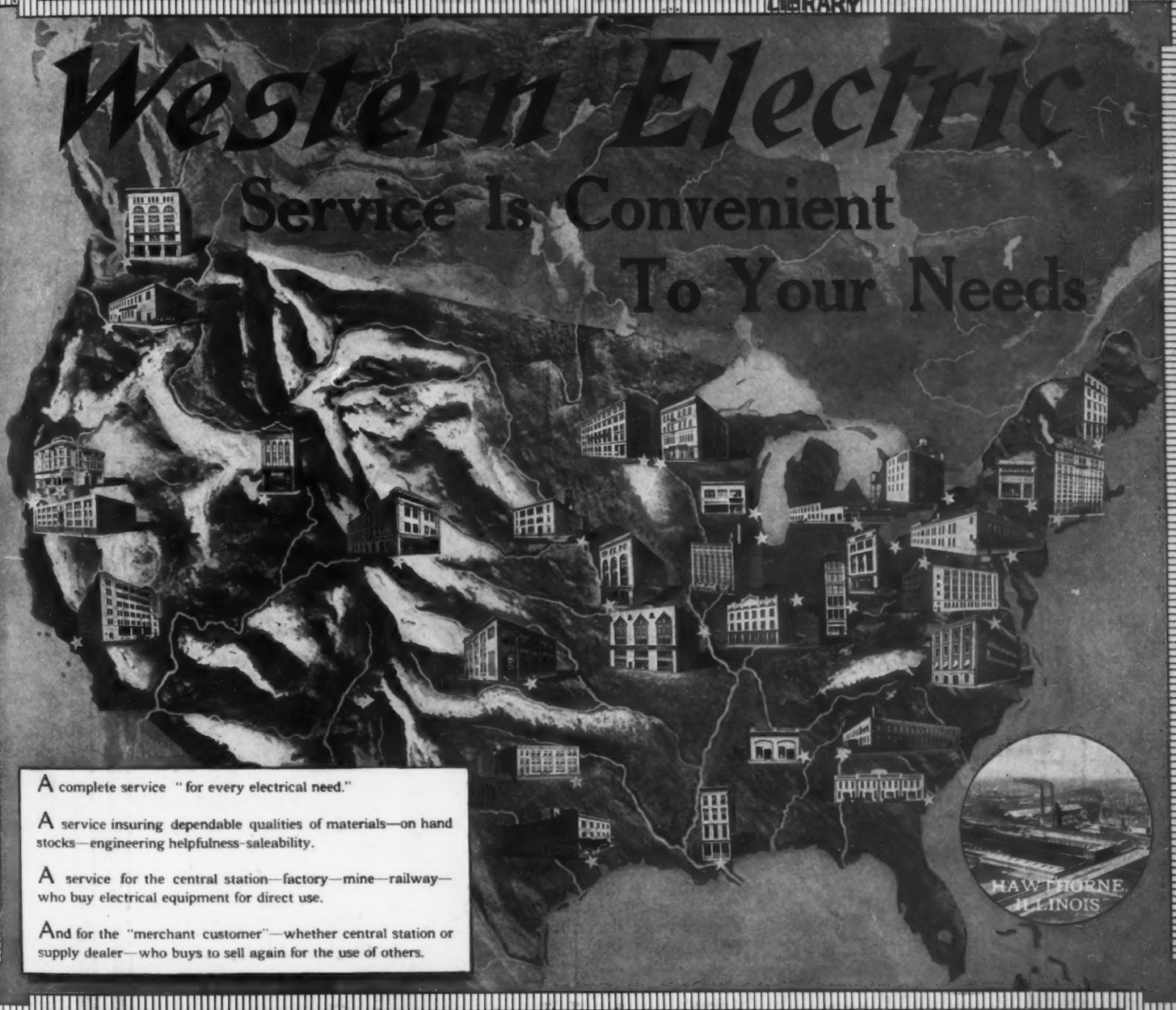
Electrical World

Volume 67 Number 26 McGraw Publishing Co., Inc. New York, June 24, 1916

Engineering Library

JUN 24 1916

UNIV. OF MICH. LIBRARY


Western Electric
Service Is Convenient
To Your Needs
A complete service "for every electrical need."
A service insuring dependable qualities of materials—on hand stocks—engineering helpfulness-saleability.
A service for the central station—factory—mine—railway—who buy electrical equipment for direct use.
And for the "merchant customer"—whether central station or supply dealer—who buys to sell again for the use of others.
HAWTHORNE, ILLINOIS

SAVE TIME AND FREIGHT

DYNAMOS-MOTORS WESTERN ELECTRIC COMPANY CABLE-TELEPHONES-SUPPLIES

TELEPHONE OUR NEAREST HOUSE

Western Electric Company

INCORPORATED

New York	Atlanta	Chicago	Kansas City	San Francisco
Buffalo	Richmond	Milwaukee	St. Louis	Oakland
Newark	Savannah	Indianapolis	Dallas	Los Angeles
Philadelphia	New Orleans	Detroit	Houston	Seattle
Boston	Birmingham	Cleveland	Oklahoma City	Portland

Pittsburgh Cincinnati Minneapolis St. Paul Omaha Denver Salt Lake City

MEMBER OF THE SOCIETY FOR ELECTRICAL DEVELOPMENT INC NEW YORK — SERVICE ECONOMY EFFICIENCY SAFETY

EQUIPMENT FOR EVERY ELECTRICAL NEED "DO-IT ELECTRICALLY"

Line up with Western Electric Service--It Pays

Your Electrical Instruments—The Pulse of Your Plant!

Your electrical instruments are the pulse of your plant, whether central station, individual plant or laboratory. Upon their efficiency depends the efficiency of your electrical equipment.

Every electrical engineer knows this, and nearly all know that

Weston

A. C. Switchboard Indicating Instruments

POWER-FACTOR METER

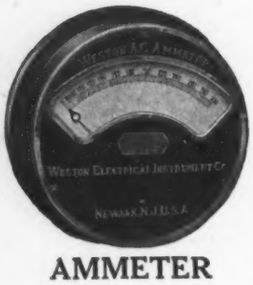
are unrivalled with respect to mechanical and electrical design and workmanship, and hence with respect to performance.

Competent engineers know that this Weston group is the only one which perfectly meets the practical requirements of operating service, and they likewise know that the initial cost is little if any more than the cost of inferior instruments and that because of their continuous accuracy and serviceability they are much more economical to adopt than instruments of any other make.

The Instruments, consisting of Ammeters, Voltmeters, Wattmeters (Single and Polyphase), Power Factor Meters, Frequency Meters and Synchroscopes, are thoroughly described in our Catalog 16.

Complete groups of Weston Switchboard Instrument Transformers are described in our Bulletin 1501.

VOLTMETER



AMMETER

WATTMETER
Single and Polyphase

Weston Electrical Instrument Co.
13 Weston Ave., Newark, N. J.

New York	Boston	Richmond	San Francisco	Vancouver
Buffalo	Philadelphia	Chicago	Toronto	London
Cleveland	Pittsburgh	Detroit	Winnipeg	Paris
Cincinnati	St. Louis	Denver	Montreal	Petrograd

Florence, Johannesburg, South Africa

Electrical World

The consolidation of ELECTRICAL WORLD AND ENGINEER and AMERICAN ELECTRICIAN.
Published by McGraw Publishing Company, Inc.

Vol. 67 NEW YORK, SATURDAY, JUNE 24, 1916 No. 26

Welcome—Engineers

THIS month sees the coming of hundreds of men into the industry—young men with new hopes and fresh aspirations. Out from our engineering schools and colleges they come to start in on work where ten, fifteen or twenty years ago we started. Some will go into the great manufacturing companies—the post-graduate schools of so many electrical engineers; others will take up railway or telephone or central station or other specialized lines. With hundreds of men the new work will be their first experience with the one universal factor of all work—getting along with men. The time clock brings a new discipline, the foreman and the fellow-worker a fresh understanding of human values. These newest electrical men are to find that while knowledge counts, putting knowledge to work to get results is what we are paid for. They bring enthusiasm, we give experience. Let not one dull the other, but let both aid in the working out of the many and detail problems in a great and many-sided industry.

What the Public Thinks of Us

A REMARKABLE collection of posters, illustrating America's Electrical Week, is now on exhibit at the Anderson Galleries in New York. Through the efforts of the Society for Electrical Development about 7000 artists and art students were asked to portray in poster form their conceptions of electricity in the daily life of the nation. Approximately 800 designs were received and about 200 have been hung for public view. No man of the industry can inspect these posters without being profoundly impressed with the way in which electricity is interpreted by the public. The electric light, the push button, the trolley car, lightning, Niagara Falls, all are found as parts of the poster designs. Electricity is personified as a master-servant, as a beautiful girl, as a mighty giant and as a god hurling thunderbolts. School-boy artists, doubtless interpreting the family's conception of the energy in their homes, seem to have a clearer idea of what electricity does, of its usefulness, than is conveyed in the finished posters of those artist competitors who have more knowledge of the principles of design and the values of color. Every man in the industry whose work brings him in contact with the man outside it, should see this exhibit for the help it may give him in better interpreting his work to his public. No industrial electrical engineer will talk *watts* to a factory manager after seeing this exhibit. He will talk *savings*. No central station man will refer to electrical appliances as *current-consuming devices* but as *labor-saving conveniences*. No advertising man will get up booklets showing the small daughter doing the family washing in her Sunday clothes. It's not a new story, but the poster exhibit drives the thought home once more that the basis of the art of publicity is to talk to the public, whether they are voters or buyers, in their own language.

Knowing the Cost of Doing Business

CHAIRMAN Hurley of the Federal Trade Commission has given a new impetus to the study of better methods of keeping costs, by pointing out the high percentage of corporations which are conducted with little or no profit. One of the papers presented before the National Supply Jobbers Association called especial attention to the need of more accurate knowledge of the costs of doing business on the part of both electrical manufacturers and jobbers. The common practice of applying one overhead charge to the cost of material and labor on individual lines is a weakness in many businesses. Not until costs are kept by lines is real knowledge of which lines are profitable and which are handled without profit available. Prices in many lines are made on little more than guesses. Cost keeping and accounting are generally looked upon as routine clerical matters. When the head of a jobbing or manufacturing business really analyzes where he stands he gets many surprises. Mr. Hurley's reiteration of the need of more accurate cost knowledge should be accepted as fact and acted upon.

Opportunities for the Electric Vehicle

HOWARD ELLIOTT, president of the New York, New Haven & Hartford Railroad Company, in a recent address on the value of co-operation wittingly or unwittingly made an eloquent plea for the electric truck for removing congestion at freight terminals. A freight car is not fulfilling its real purpose when it is standing still, neither is a railroad track when cars stand idle upon it; and yet, because of freight congestion, the New York, New Haven & Hartford Company paid during a 100-day period for the use of freight cars of other roads $1,225,000. Calling attention to this economic waste, Mr. Elliott said: "How much better it would have been for the New Haven Railroad and the manufacturers if that money could have been used to purchase more automobile trucks and warehouses, so that the moment freight came into New England it could be taken out of the car, put into the automobile, taken to a warehouse and the car been ready to go back to its home road to make another trip." This problem of terminal freight congestion has already been dis-

cussed by the Electric Vehicle Association of America, and Mr. Elliott merely corroborates, in an official way, just what this means to the great railroad systems. The problem calls for a remedy involving co-operation between the manufacturer and the railroads. Storage of freight in railroad cars is not only very expensive to the manufacturer, but it deprives the railroad of the use of its cars and some other manufacturer of his goods because of the congestion occasioned thereby. The electric truck, as has been very often pointed out, is admirably fitted for freight terminal work, and the Electric Vehicle Section of the National Electric Light Association and individual central stations might with profit bring this unimpeachable testimony of Mr. Elliott to the attention of the manufacturers of the country or have the manufacturers of electric vehicles themselves do so.

Flood-Lighting for Sports

ONE of the very interesting recent developments in outdoor illumination is artificial lighting for various sports which are ordinarily pursued only by day. The provision for lighting indoor lawn tennis courts has been practised for some years. This is a comparatively easy problem, being merely the brilliant illumination of a large hall. In the beginning the arc lamp was the mainstay of such work, and more recently the big gas-filled lamps have been very successfully utilized. The main function of such an installation is to provide light of even and high intensity without glare. The requirement of even light is comparatively easy of fulfillment, but that for the elimination of glare is more difficult. Where the height is adequate, deep reflectors are successful, and the only peculiar provision is a screen of netting to prevent flying balls from breaking the lamps. So far as the lawn tennis court is concerned the 5 to 8 foot-candle has been about the usual requirement, and the conditions are best met by a moderate number of rather large units, such as are furnished by arcs or 400 or 500-watt gas-filled lamps.

The next stage of sport lighting included court tennis, racquet, squash and handball courts. The requirements in these cases are somewhat modified by the fact that the walls as well as the floor must be fairly well lighted. For court tennis arcs, mercury-vapor tubes and gas-filled incandescent lamps have all been successfully used. The area of such a court is about 3000 sq. ft., and even with the high efficiency illuminants referred to, an allowance of 2 to 3 watts per square foot has been found necessary to obtain good results, rather more than was customarily employed for lawn tennis, owing particularly to the ricochetting of the balls in the corners, which have to be particularly well lighted. It is probable that neither in lawn tennis nor court tennis can quite so fast a game be played by artificial light as by natural light, yet the results are on the whole, rather satisfactory. Squash and handball courts have been very successfully illuminated at an expenditure for energy somewhat less than for tennis courts. A racquet court, on the other hand, is very much more difficult to light than any of those before mentioned. The space is only about 1800 sq. ft., but the walls are customarily coated with black cement, which greatly reduces the effective illumination. The ball is small, a scant inch in diameter, and the pace is terrific. For good results the illumination ought to be pushed to the higher limit employed in court tennis and, even so, a fast game is not altogether easy.

From these specialized requirements of indoor work the passage to outdoor illumination of sports has been an easy one. The outdoor lawn tennis court requires about the same illumination as in an indoor game, but the proper placement of the lamps is rather more difficult. Two different plans are in use, each involving the stringing of lamps, carried from 20 ft. to 35 ft. above ground, on bearer cables along the courts. One of the earlier arrangements was to string two such cables, one near each side line just outside the court, carrying incandescent lamps in reflectors, an arrangement which gives good illumination but considerable glare. A somewhat less easy but very efficient plan is to take one, or better, two, bearer cables lengthwise over the court at a height of 30 ft. to 40 ft., and carry the lamps in big and deep reflectors to cut down the glare pointing vertically downward from these cables. The main point is to have the skirts of the reflectors deep enough to prevent the lamps shining into the eyes of the players under ordinary conditions, and the lamps, of course, have to be screened against the results of a high lob. Such an arrangement has proved to be quite satisfactory, and many such courts are now in use. Of course, flood-lighting for amusement parks, bathing beaches, and so on, is a much simpler matter because of the modest requirement for illumination. The amusement park, in fact, requires merely a modification of high-grade street lighting equipment.

A recent interesting development is the illumination of trap-shooting grounds, so that this sport can be carried on in the evening as well as by day. It would seem at first to be a very difficult task brilliantly to illuminate the somewhat indefinite space covered by the flight of the targets so that shooting would be in any sense easy. A few clubs are now equipped, however, and, on the whole, the results are rather good, as judged by the scores. The requirements for illumination are peculiar. Shooting is usually at 16 yd. to 18 yd. rise and, at the traps, the lighting must be rather brilliant over a semicircle of something like 40 yd. radius, and to half this height in the outer parts of the area. These requirements seem to be best met by a rather strong general illumination of the space between shooter and traps from lamps placed high and back of the shooter, together with a bank of reflectors screened just in front of the traps so as to flood the targets in brilliant light as soon as they appear to facilitate catching a quick sight. The same distribution of light outward and slightly upward will enable the targets to be followed until they are either broken or out of range.

Sports like baseball and golf require still more strenuous efforts at illumination, and lighting for these cannot be considered as past the preliminary experi-

mental stage. Enough has been done all along the line to show that here is one of the not unimportant fields for electric lighting particularly deserving of cultivation, because it strengthens the demand for energy during the evening period when the load is generally somewhat reduced.

An Electric Arc Furnace for Laboratory Use

THE value of the electric furnace in metallurgical investigations is constantly increasing. In no other way can high temperatures be so conveniently measured and controlled, while the materials operated upon can be protected from impurity to a remarkable degree. In our digest this week appears a reference to a recent article by Dr. O. P. Watts on an electric arc furnace for use in the laboratory. This is a description of a convenient type of experimental furnace for melting and alloying about 5 kg. of metal at each heat. The temperatures carried in this furnace are stated to be as high as 2420 deg. K., or 2150 deg. C. At such temperatures great difficulties are met in maintaining the thermal insulation and in keeping the furnace walls intact, to say nothing of the oxidization of the electrodes at and near the external surface. Magnesia and slaked lime are the materials emphasized. The practical hints and suggestions contained in the article will be serviceable to those who may be designing and constructing a small 30-kw. laboratory arc furnace for the first time; especially if temperatures over 2000 deg. K. are to be attained. An enormous range of experimental research lies in the domain of such furnaces, and it is quite within the scope of possibilities that the high-temperature metallurgical processes of the present day may be materially modified and improved by the results of such researches.

The Merchandising Opportunity

ENGINEERING, inventive and manufacturing ability and organization have put electrical apparatus and appliances at the service of the consumer in the proverbial "thousand and one" directions. The central station delivers electricity at the door of the consumer. And where central station service does not reach the gasoline-engine maker is rapidly developing an effective prime mover and teaching the customer how to use it.

The electrical inventor and manufacturer have developed efficient appliances for electric operation and created a widespread demand for them. And the electrical man who should be reaping a golden harvest from this condition is, except in a comparatively few sporadic cases, permitting this remarkable merchandising opportunity to pass quietly by.

ELECTRICAL WORLD has been pointing out this opportunity for *electrical merchants* for a long time. In an editorial in our issue of Aug. 7, 1915, in commenting on an incident of department store selling we said: "Either the electrical dealer must wake up and learn how to merchandise or the department-store merchant must reform and learn a few simple lessons in electricity. The question is who will act first. The successful merchandising of electrical appliances over the counter demands action."

The electrical business is here, and for electrically trained men who have a spark of selling or merchandising ability, opportunity has been knocking so long without securing a satisfactory response that, to quote the recent statement of an enthusiastic advertising man, "she has begun ringing a fire alarm."

A recent advertisement in our columns puts the merchandising opportunity so clearly that we cannot forebear quoting the following paragraphs:

> For the electrical man who will *turn merchant* and establish and identify himself with channels of supply for this ready-made demand, an ever-growing and profitable business awaits.
>
> It is only because *electrical* men are not giving attention to proper merchandising (selling) methods, that the sale of electrical supplies is overflowing into department stores, hardware stores, drug stores and other channels of supply.
>
> The consumer does not choose to buy electrical goods from a drug or dry goods store. He *prefers* to buy them from, and should be served by an electrical supply dealer.
>
> Consumers want to be "shown" *how* to properly use electrical goods. They want *service* in case anything goes wrong through their ignorance and misunderstandings.
>
> The electrical contractor (so called) has here a rare opportunity.
>
> He and his men know electricity. In this his advantage is supreme.
>
> His only problem is to develop *correct, profitable* merchandising methods.

This opportunity is one of pressing, vital and fundamental importance for the whole industry. It largely concerns the future development of the central station business. It is certainly a matter of vital concern for the manufacturer of electrical goods of all kinds. And it is the golden opportunity of the electrical dealers and contractors.

The retail merchandising phase of the electrical business should be as large, as prosperous, as efficient and as well established as any other phase of the industry. It is time that the electrical trade woke up. Until a retail electrical trade becomes aggressive and efficient in merchandising methods, the electrical industry can never attain its highest possibilities for the profit of the industry or the service of the public.

It is with this background that the publishers of the ELECTRICAL WORLD, as announced last week, beginning on July 15 will supplement the service of the ELECTRICAL WORLD with the journal ELECTRICAL MERCHANDISING. ELECTRICAL WORLD will continue to record and describe the commercial developments that affect the industry as a whole. ELECTRICAL MERCHANDISING will treat of the detail merchandising, sales and business questions of the dealers and contractors, the jobbers and manufacturers and the central station salesmen. Its editorial aim will be to help its readers to capitalize this tremendous trade opportunity.

Chronicle of Events of the Industry and of Important Movements in the Field

NEWS OF THE WEEK

Reports of Conventions and Meetings of Electrical Associations and Societies

Merchandising and Public-Policy Topics Discussed by Michigan Association

The fifth annual convention of the Michigan Section of the National Electric Light Association held on board the steamer Arizona on the Great Lakes, June 18 to 22, proved as enjoyable for the delegates and ladies as any convention cruise yet held by the Michigan body. In the convention business sessions chief interest centered around questions of public policy and electrical merchandising.

Papers were presented as follows: H. H. Crowell of Jackson, "The Utility and the Community"; John A. Cavanaugh of Benton Harbor, "Troubles"; A. C. Marshall of Detroit, "Street Lighting Service by Municipally-Owned Plants" (read by Herbert Silvester of Rochester, Mich.); H. E. Eisenmenger of Cleveland, Ohio, "Concentric Wiring" (read by J. R. Colville of Cleveland); W. D. H. Thomas of Lansing, "Merchandising Electrical Appliances" (read by C. W. Johnson of Jackson); J. V. Oxtoby of Detroit, "Tree Trimming," and M. D. Cooper of Cleveland, Ohio, "Voltage Standardization" (read by M. R. Colville). An informal discussion on industrial electric-heating topics also took place.

The feature of the entertainment program was a half day's trip through the Thirty Thousand Islands of Georgian Bay on the smaller steamer Warfic, which plies between the Canadian ports Parry Sound and Penetang. Another half day was spent at Penetang, where a unit of Canadian volunteers was preparing for service overseas.

Western Governors to Discuss Water-Power

Nine governors of Western states and probably three ex-governors, including ex-Governor West of Oregon, will be present when the conference of Western governors convenes at Salt Lake City on June 26. The Western governors' conference will be followed by the national conference of State executives on June 27, 28 and 29. The tentative program as arranged by Governor Withycombe, secretary of the Western governors' conference, will include an address of welcome by Governor Spry of Utah and an acknowledgment by Governor Lister of Washington, president of the Western conference. Governor Boyle of Nevada will discuss "Public Lands and Water-Power"; Governor Carlson of Colorado, "State and Federal Aid in Land Settlement"; Governor Alexander of Idaho, "State Administrative Problems"; Governor Hunt of Arizona, "State Administrative Problems"; ex-Governor Hawley of Idaho, "The West and Its Water-Power." Governor Withycombe will read a paper entitled "Practical Preparedness for the Pacific Northwest."

Tax on Electrical Energy Proposed for Russia

At a meeting of the indirect taxes and monopolies committee of the Russian government, held in Petrograd on May 13, a tax on electrical energy was considered. According to the scheme of the Russian minister of finance, it was proposed to put a tax on electrical energy used for lighting and for industrial purposes, the general tax for private lighting to be at the rate of 4 kopecks or 2 cents per kilowatt-hour, and that for street lighting 1 kopeck or 0.5 cent. Energy for industrial purposes is to pay 2 kopecks or 1 cent, and for certain auxiliary industries 0.5 kopeck or 0.25 cent. The representatives of industry said that to put a tax on electricity used for industrial purposes might very prejudicially affect the development of the country's productivity; but most of the committee found such a tax to be quite admissible if moderately applied, the more so as such an indirect tax would be transferred by the producers to the consumers. The question of the monopolization of the production of electrical energy was raised and it was decided to submit it to a special financio-economic committee. The committee approved the project of the new law.

America's Electrical Week Local Committees Appointed

Every city with a population of 20,000 or over will have a committee in charge of local arrangements for the America's Electrical Week campaign this fall. The national executive committee in charge of the movement, of which Gerard Swope, vice-president of the Western Electric Company, is chairman, recently announced its appointments of chairmen and local committeemen. More than 1100 representative electrical men have been appointed. Two hundred and seventy-five cities in forty-six states are represented. The executive committee, through the Society for Electrical Development, made every effort to have the list representative of the different electrical interests, the Jovian Order, the Rotary clubs and civic associations where they rendered co-operation during the Electrical Prosperity Week campaign of last year.

Convention of New Jersey Contractors

The need of better co-operation between electrical contractors and central stations, the elimination of Underwriters' inspection fees, and the desirability of including all contractors in the New Jersey Electrical Contractors' Association were the keynotes of the convention of the association held on June 17 at Asbury Park, N. J. There were approximately 100 in attendance at the convention, which began with a luncheon and ended with a dinner.

After an executive session at which routine matters were discussed, the general session began with a discussion of methods of expediting meter connections. C. F. Adam of Trenton suggested that central stations be requested to cut down the time necessary in making meter connections in new installations, and F. T. Sturges of the Public Service Electric Company said that it took about two weeks to get a requisition through and that it would be necessary for central stations to make connections in the order of the receipt of requisitions. Howard Newman of Passaic, N. J., suggested that if contractors would notify the central station as soon as they receive the job and not wait until it is completed

delays in meter connections would be obviated. He voiced the need of more intimate acquaintanceship between central station men, and contractors and the association indorsed the sentiment.

A. W. Young of the Public Service Electric Company suggested that the salesmen and service men of the central stations be advised of the doings of the contractors' association through the Public Service Bulletin so that they would be better able to co-operate with the contractors in their various campaigns. Mr. McBridge of the Atlantic Coast Electric Light Company told of the co-operation of that company with local contractors in a special wiring campaign last winter, in which customers were allowed to spread their payments over the year but the contractor was paid by the lighting company upon the completion of the work.

An animated discussion ensued on the subject of Underwriters' inspection fees. One contractor intimated that a bill would be presented to the Legislature that would make it compulsory for the insurance companies to pay the inspection fees since they were the ones primarily interested in good wiring. S. Andrews of the Underwriters' Bureau of Philadelphia, however, stated that the function of the inspection bureau is to prevent fires and not to make money. Moreover, the contractor did not pay the inspection fee, the charge being against the owner of the building wired. Inspections are made for the protection of the owner of the building and for society in general, and if it were necessary to raise insurance rates owing to inferior wiring, two-thirds of the contractors would be forced out of the business. President E. P. Strang contended that all insurance companies should maintain their own inspection bureaus like the Factory Mutual Insurance Company; but T. F. Dorris, chief inspector of the Fire Insurance Society of Newark, said this would increase overhead expenses and of necessity insurance rates in general.

Many suggestions were made as to methods of increasing the membership. A. W. Young of the Public Service Electric Company, Camden, said that the Camden County Contractors' Association should be induced to become members of the State Association. He also suggested that local sections of the State organization be formed so as to make it easier to promote better local co-operation between the contractors, inspectors and central stations. President Strang said that the benefits to be derived from membership in the State organization outweighed considerably the small cost of membership.

Display of Posters Designed for Electrical Week

A remarkable collection of posters designed for the fall celebration to be known as America's Electrical Week, from Dec. 2 to Dec. 9, by artists, art students and high school pupils in all parts of America, and valued by them at more than $100,000, has been on exhibition during the past week in the Anderson Galleries, New York City.

The exhibit is under the auspices of the Society for Electrical Development, which offered $2,200 in prizes for the most suitable poster design.

In all 781 poster designs were received. These came from practically every leading city of the United States. High schools submitted 204 posters. From the art schools of the United States the committee received 194 posters.

A prize of $200 will be awarded to the best art student poster and $200 more will be divided in prizes for the five best high school posters. The design selected by the judges for the grand prize of $1,000 will be the official emblem of America's Electrical Week.

The "Biggest Things" in Water-Power Development

From an exhibit of water-power development conducted at the Massachusetts Institute of Technology in connection with the recent dedication of the new buildings in Cambridge, the following data relative to the "high spots" so far attained in this work are culled. The largest high-head development in the United States and Canada is that of the Pacific Power & Light Corporation at Big Creek, Cal. In the two plants now operated in the Sierras in connection with the 240-mile transmission to Los Angeles, the average head is about 2000 ft., the larger head being 2150 ft. The water-wheels are the most powerful tangential units in service, being rated at 23,000 hp. each, and the storage capacity of the main reservoir, Lake Huntington, 120,000 kw. continuously for eight months, carries off the palm for any development of the kind on the continent. The largest producer of hydroelectric power is the Ontario Power Company, Niagara Falls, Ont., which develops 180,000 hp. in fourteen horizontal units at capacity load factor. The Keokuk (Iowa) plant of the Mississippi River Power Company has the honor of being the largest low-head development, having a total rating of 150,000 hp. at 32 ft. The most powerful turbines are machines of 25,000-hp. rating under 160-ft. head, in the Long Lake development of the Washington Water Power Company, near Spokane. The most powerful vertical turbines are several 20,000-hp. machines of the Laurentide Company, Ltd., installed in a plant on the St. Maurice River in the Province of Quebec. The largest turbines in size are those of the Cedars Rapids Power & Manufacturing Company, near Montreal, Que. These units have a turbine and generator weight of 850 tons, and a turbine runner diameter of 17 ft. 8 in.

Commonwealth Edison Annual Field Day

The annual field day of the Commonwealth Edison Company employees was held at Riverview picnic grounds on Saturday afternoon, June 17. There were all manner of contests, athletic and otherwise, and prizes for each, including ten electrical prizes. The Edison band was also on the picnic grounds to liven things up, and the big electric family was out 3500 strong for the frolic. Special cars were run from the loop to the picnic grounds. The annual event is given under the auspices of the Commonwealth Edison section of the National Electric Light Association.

AROUND THE VARIOUS CONCESSIONS AT THE COMMONWEALTH EDISON ANNUAL FIELD DAY

Automatic Operation of a Small Hydroelectric Plant in North Carolina

Arrangements by Which Generator Operates Without Attention and Indicates Character of Trouble When it Develops

By D. R. SHEARER

Several features of rather unusual design have been utilized in the construction of the small hydroelectric plant of the New River Light & Power Company at Boone, N. C. This plant has a rating of 75 kva. and

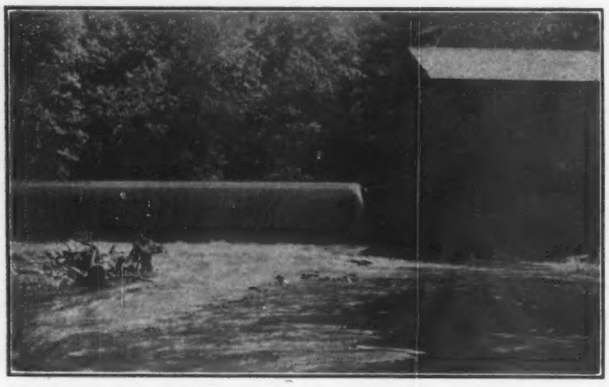


FIG. 1—75-KW. HYDROELECTRIC STATION AT BOONE, N. C. WHICH OPERATES WITHOUT ATTENDANT

furnishes light and power service to the town of Boone and to the Appalachian Training School, a State normal institution located in the town. Since it was necessary to haul the equipment used in the erection of the plant 33 miles over earth roads with steep, heavy grades, it was decided that a timber dam would prove more economical than concrete. However, the dam is so constructed that in case it becomes advisable, a gravity section stone or concrete dam can be built without interrupting the operation of the station. In connection with the installation of the mechanical and electrical equipment rather peculiar conditions had to be met. It was practically out of the question to provide skilled attendance so that it was necessary to make the operation of the plant as automatic as possible. The manner in which this was accomplished is outlined in what follows.

The 40-in. vertical wheel is set in a decked forebay and drives a horizontal jackshaft through a quarter turn rope drive. This jackshaft in turn is belted to the 75 kva. generator which runs at 900 r. p. m. The wheel is governed by a compensating governor and the voltage is controlled by a compensating Tirrill regulator. The load factor of the plant is high and in addition there are frequent violent peaks from the starting of induction motors which are operated at the end of the 3-mile transmission line.

AUTOMATIC FEATURES

Under these conditions the plant requires only about thirty minutes' attention during the twenty-hour run. Should any conceivable trouble develop or abnormal operating condition arise the plant both stops itself and rings a large gong on the outside of the building. This gong rings without stopping until the condition of trouble is removed. Whether the wheel stops or continues to run depends on the seriousness of the abnormal condition.

The water wheel governor has been fitted with a magnetic trip which is controlled by manually operated buttons, a time switch and also by telltale contacts on the rope drive, belting, etc. This feature has proved a positive protection against frayed or displaced ropes and belts. As a usual thing the time switch is set to stop the wheel at midnight to conserve water until 4 a. m., when it is started again.

On an annunciator board to the left of the switchboard are five drops which indicate the origin of any trouble that causes the bell to sound. The indications are as follows:

1. Frayed or broken ropes or belts or tension carriage at the end of track.
2. One or more hot bearings or overloaded generator. All bearings and generator are equipped with thermostats.
3. Speed above or below normal, indication from governor.
4. Automatic oil switch tripped.
5. Voltage above or below normal.

STORAGE BATTERY SERVICE

The current operating the annunciator, bell and governor trip is normally taken from the exciter through a suitable resistance. After the plant is shut down by some abnormal condition a relay shifts to a storage battery which continues to operate the bell until the operator arrives to remove the trouble and start again. The storage battery also supplies several low-voltage lamps which can be used when the plant is not running. The bell does not ring when the plant is shut down by the time switch since the switch opens the bell circuit at the instant it closes the trip circuit on the governor. The operator who attends the plant lives within hearing distance of the bell so that he can drop his regular duties and correct any trouble when called by the alarm. He is regularly employed in a mill located several hundred feet from the power house. The alarm equipment is very similar to that described on page 208 of the ELECTRICAL WORLD of Jan. 25, 1913. Gate opening and water level indicators are placed over the annunciator board. Light for the building and for adjacent consumers is secured from a small transformer or from the exciter.

This plant has been operating regularly twenty hours

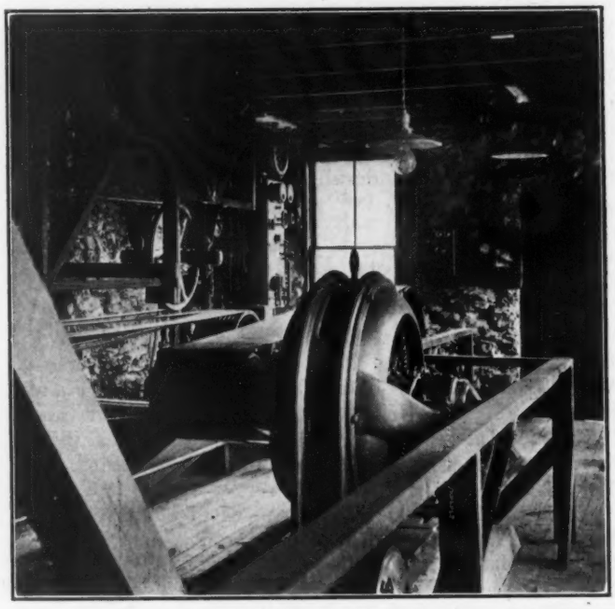


FIG. 2—GENERATOR CONNECTED TO WATER WHEEL BY ROPE DRIVE, AND AUTOMATIC CONTROL BOARD IN REAR

per day for several months. The machine operation has been satisfactory, maintaining a remarkably steady voltage for its size and the cheapness of the installation. The cost of the entire plant equipment did not exceed $6,000. All the special equipment and control was designed and built locally.

Portland Railway & Light Valuation

Oregon Commission Makes No Allowance for Going Concern Value, Although It Is Willing to Hear Further Testimony on It

IN one of the largest valuation cases ever tried in the country, the Public Service Commission of Oregon has handed down a decision in the matter of the value of the Portland Railway, Light & Power Company system of railways, light plants and other properties in western Oregon. Now that the valuation has been decided on by the commission, the next matter to be taken up will be that of rates, unless the company can secure additional consideration of the valuation question. The only rate matter decided on in the valuation case has been the minor one of form of billing, which directs the company to discontinue making out monthly bills in a net amount with a penalty to be added for non-prompt-payment, and instead directs the company to make out bills in a gross amount with a prompt payment discount.

REPRODUCTION COST LESS DEPRECIATION

The commission has decided that the "bare bones" value of the company property or reproduction cost less depreciation amounted to $40,823,833.50 on June 30, 1915. This is $877,940.50 less than the company claimed the same valuation to be according to its method of calculation. The commission's valuation of the reproduction cost new is $45,375,027. It is believed that this estimate will form the basis of the various rate investigations that will be made. The figure does not include any working capital, going value, investments in subsidiaries, construction work in progress or investments in undistributed construction accounts. The commission has made no allowance for going value, but an inspection of the decision indicates that it is willing to receive additional testimony on this point and will give it attention in the future.

The investigation into the value of the company has taken three years time, and has cost in the neighborhood of $140,000. The company holdings are very extensive, including about 300 miles of railway lines, and electrical service to about 40,000 customers furnished by ten steam and hydroelectric plants.

The company's complete claim before the commission was $61,040,004. The largest eliminations by the commission were $7,489,446 for "going value" and about $6,000,000 for property that the commission did not consider useful as public utility property. The commission will allow working capital to the amount of $1,110,000 instead of $1,850,000 deemed necessary by the company.

The commission concedes that the company's earnings have been falling off materially, and puts the blame of this on jitney competition and electrical competition in Portland. The commission's remarks on this point are as follows:

"It will be noted that the last few years has shown a marked falling off in earning capacity. This is shown by the record to be due to the following three causes: General and local depressed business conditions; the advent of competition in the electric lighting and power field, which has taken from the respondent a considerable proportion of its most profitable traffic and without correspondingly diminishing fixed and running charges and the practically uncontrolled destructive competition of jitneys, with the Portland city street railway system. While revenue has fallen off, it is evident that the effect has been kept to a minimum by rigid economy in other directions. To a very considerable extent the conditions shown for the last three years are abnormal; and the causes for the conditions have apparently reached the climax of their effect."

GOING CONCERN VALUE

The commission apparently considers the question of going value to be debatable. Part of its decision reads as follows:

"In this figure the utility included $7,489,446 as representing the cost of developing its business, commonly known as 'going value' and which is not included in the figure found by the commission as representing the reproduction of physical properties. Whether this claim of going value is reasonable is not determined in the present findings. The theory upon which the going value claim was made is not approved by the commission, and the utility is afforded the opportunity to present further testimony upon the question of going value in order to bring its claim for this element of value, which is well recognized in utility valuations, within the rule of modern decisions.

"The amount claimed by the utility as representing going value is equivalent to 16 per cent of the figure found by the commission as reproduction cost of the physical property of the utility. In the appraisal submitted by the utility a claim was made that the value of its water rights used in both utility and non-utility operations, was $6,000,000. The supreme court of the United States has laid down a rule that developed water rights shall be valued in proceedings of this character.

"The commission, by its decision, materially reduced the claim of the utility for water right values, and the principal differences between the appraisals submitted

Salient Facts About P. R., L. & P. Valuation

Salient points of findings made regarding reproduction cost of Portland Railway, Light & Power Company by the Public Utilities Commission show:

Company's estimate of value of property, including $7,489,446 for going value	$61,040,004.00
Company's estimate reproduction cost (new) less going value	53,550,558.00
Commission's estimate reproduction (new)	45,375,027.00
Less than company estimate	6,325,531.00
Company estimate of reproduction, less depreciation	41,701,773.00
Commission's estimate, less depreciation	40,823,833.50
Less than company's estimate	877,940.50
Difference between company estimate of property value and commission estimate of reproduction, less depreciation, but not crediting company with going value, working capital, investments in subsidiary corporations, construction work in progress and undistributed construction accounts	12,626,714.50
Net income losses of company:	
1912	33,480.02
1913	102,105.22
1914	294,175.22
1915	820,211.87
Deficit in surplus account:	
1913	1,405,525.41
1914	488,944.58
1915	8,417.22
(Decrease in deficit was caused by non-payment of dividends.)	
Outstanding securities:	
*Common stock	20,000,000.00
Preferred stock, 5 per cent	5,000,000.00
Short term notes, 5 per cent	5,000,000.00
Bonds	34,964,000.00
Total outstanding securities	64,964,000.00
Market value, June 30, 1915	42,459,879.00

*Of the common stock issue 75 per cent has been paid, leaving an outstanding stock liability of $15,000,000, and a stock asset, subject to call, of $5,000,000.

by the utility and the ultimate findings of the commission lie in the elimination, for the present, of the utility's claim for going value, in reduction in the claim for water right and real estate values, in the reduction of percentages for overhead costs added to specific construction, and in a decrease in the amount claimed as working capital."

The commission finds that the company is now paying interest on $1,057,000 of city bonds for pavements. The company had no share in determining if this money should be spent, though it was one of the heaviest payers. It has already paid off about $1,000,000 of these bonds. The commission finds that out of every dollar taken in by the company, 20 cents is paid out to city, county and state for taxes, franchises, bridge rentals and other items of a similar nature. The commission states specifically that the present findings are not to be considered the value of the company as a business entity.

The commission found that the aggregate investment of the present holders amounted to $54,047,042, but this, of course, includes all company property.

STATEMENT OF PRESIDENT GRIFFITH

Franklin T. Griffith, president of the Portland Railway, Light & Power Company, has made the following statement in regard to the decision:

"The findings of the Public Service Commission have just been served on us and we have, as yet, had no opportunity to analyze the values found. Since the inventory was commenced three years ago, the commission has prescribed a system of accounting which was not in use during the taking of the inventory and the making of the appraisal. The findings of the commission now rendered follow the form of accounting now prescribed by the commission, and for that reason comparisons between the commission's findings of value and the appraisals submitted by the company can be made only after an exhaustive analysis of the findings.

"From such study as we have been able to give the findings it appears that the commission materially reduced our claims as to cost of construction of the physical property and also the values claimed for our rather extensive holdings of real estate used in both utility and non-utility operations. To what extent the commission has been influenced by the abnormally low prices of real estate during the last two years of extreme depression, we are unable to determine.

"One large item of value claimed by the company and which is not included in the commission's findings is the intangible element of going value which is representative of the cost to the company of developing its business and which is not represented by tangible physical property. The claim of the company for this item was approximately $7,500,000, and this entire amount is excluded in the findings of the commission, although the findings state that going value is recognized in utility valuations as an important element and that the commission is willing to consider the allowance of a going value, provided that upon a further hearing the company is able to comply with certain specific conditions laid down by the commission in its findings as essential to the establishment of such a claim.

"The amount claimed by the utility as representing going value is equivalent to 16 per cent of the figure found by the commission as representing reproduction value of physical property. This percentage is of peculiar interest in view of the fact that this element of value in similar proceedings elsewhere in the United States has been found reasonable by courts and commissions when reaching a figure ranging from 20 to 30 per cent of the reproduction value of physical property.

"The developed water rights owned by the company are used about one-third in non-utility operations and two-thirds in utility operations. Our total claim for water right values is $6,000,000, and while we cannot, from the findings, determine as yet the theory of value adopted by the commission, it appears that the commission has allowed us practically our appraisal of water powers used in non-utility operations, in which the rate-paying public is not interested, and on some of our developed water powers used in utility operations have allowed us not much more than nominal values."

Decision in Washington Water-Power Case

Idaho Commission Distinguishes Between Intrastate Distribution of Energy and Its Transmission from Montana into Idaho Which, It Maintains, Constitutes Interstate Commerce

The Idaho Public Utilities Commission has dismissed the complaint of the Washington Water Power Company of Spokane, Wash., against the Federal Mining & Smelting Company, the Tamarack & Custer Consolidated Mining Company (both operating in the Coeur d'Alene district of Idaho) and the Montana Power and Thompson Falls Power companies. The commission holds that the mining companies are not public utilities, and that the transmission of electrical energy from Montana to Idaho on the part of the Montana and Thompson Falls Power companies to the several mining companies named is interstate in its character.

HISTORY OF CASE

The Washington Water Power Company, which for many years has and still supplies electricity in northern Idaho, where great quantities of electrical energy are used in the operation of the mines, etc., filed a complaint with the Idaho Public Utilities Commission against the power and mining companies named, alleging that the power and mining companies had entered into a conspiracy for the purpose of evading the terms of the public utilities act. In substance, this alleged conspiracy was to the effect that the mining companies agreed to build power circuits to the Idaho-Montana boundary line, there to be met and joined by the transmission lines of the power companies, which have their generating plants in Montana, so that electricity could be transmitted by the power companies' plants to the mills and plants of the mining companies. It was further charged by the Washington Water Power Company, that it was proposed to carry out this alleged conspiracy without first securing a certificate of convenience and necessity from the Public Utilities Commission; that if the plan was permitted to go into effect, it would be of no benefit to the people and would materially injure the business of the Washington Water Power Company. The company asked that the Montana and Thompson Falls Power companies and the several mining companies be restrained and enjoined from carrying out the agreement.

PUBLIC UTILITY DEFINED

"As the case stands," said the Public Utilities Commission in its order and opinion, "the matter to be determined is whether the defendants or any of them are lawfully doing business of the character contemplated by the contract of Dec. 19, 1914, without having secured from this commission a certificate to the effect that the present or future public convenience and necessity require or will require the conduct of such business. * * * The public utilities act applies to public utilities and public services therein described and to this commission. The use of a public utility as applying in

this State is a public use furnished for compensation within this State, and if a concern is not a public utility as defined in said act it is not subject to the control, jurisdiction and regulation of this commission. * * * The definition of the term 'public utility' was not changed in the amendment of Sec. 2 in 1915. If any of the defendants should fall within the meaning of the term 'public utility' as defined, it would be in the class designated 'electrical corporations.' "

JURISDICTION OF COMMISSION

Later on the commission says: "The jurisdiction of a commission is confined within the limits of the State of Idaho, and the operations of the defendant power companies outside of the State of Idaho cannot be made a subject of regulation by this commission. It is clear that the defendant power companies did not desire or intend in the transmission herein under consideration to do business in Idaho as public utilities, and they certainly had a perfect right to decline to do such business in Idaho if they so desired. * * *. It appears from the evidence that the delivery of electrical energy to the defendant mining companies takes place in the State of Montana. This energy is transmitted wholly within the State of Montana over the lines of the defendant Thompson Falls Power Company from the generating station of said point of delivery where the said lines end. The defendant power companies may be conducting a public utility business in the State of Montana, but they are not engaged in such business in the State of Idaho."

The commission holds that the delivery of power to the Hercules boarding houses and the transmission of energy from Montana to the Canyon Creek Electric Light Company and the Mullan Light Company is subordinate to the issues involved and does not tend to show the companies are engaging in a public utility enterprise.

It is held that the question of constitutionality raised by the plaintiff company of the public utilities act is not an issue for the commission to decide, but one for the court. The plaintiff had contended the amendment of 1915 made the entire act unconstitutional if given effect. The commission fails to see the force of this argument. Taking up the issue, "Is the transmission of electrical energy from Idaho into another State or the distribution thereof in Idaho a transaction of interstate commerce beyond the reach of State regulation?" The commission holds as follows:

COMPETITION NOT DESIRABLE

"The public utilities act tends to prevent competition between electrical corporations and certain other public utilities operating in this State, and the Supreme Court of Idaho has virtually declared that it is the purpose of the act to prevent such competition unless the State shall determine that public convenience and necessity require or will require such competition, depending upon the circumstances in each particular case. If the State policy of restricting competition be applied to transactions of interstate commerce, it appears to the commission that it might operate to restrain interstate commerce in violation of an act of Congress of July 2, 1890, 'an act to protect trade and commerce against unlawful restraints and monopolies,' * * * and for that reason, and in view of Sec. 9 of the public utilities act, this commission believes that the last-mentioned act does not apply to the interstate transmission of electrical energy.

"Furthermore, if the State policy of restricting competition be applied to transactions of interstate commerce, it appears to the commission that it might operate to inhibit the receipt or disposition of an important commodity before such commodity has ceased to be an article of interstate trade and commerce in violation of the commerce clause of the federal constitution, and for that reason, and in view of Sec. 79 of the public utilities act, this commission believes that the said act does not apply to interstate transmission of electrical energy."

In view of the importance of the case to the Washington Water Power Company, the latter will in all probability contest the decision of the commission, carrying it, if necessary, to the Supreme Court of the United States.

Sale of Mount Whitney System

Property of Southern California Company Reported to Have Been Bought by the Pacific Light & Power Corporation of Los Angeles

Although the final bill of sale has not yet been signed, it is definitely understood that the Mount Whitney Power & Electric Company of Visalia, Cal., has been purchased from John Hays Hammond of New York City by H. E. Huntington, president of the Pacific Light & Power Corporation of Los Angeles.

THE MT. WHITNEY SYSTEM

The Mount Whitney Power & Electric Company owns four high-head hydroelectric generating stations with a combined rating of 13,000 hp., and a steam plant located in Visalia rated at 10,000 hp. Of the territory served, Tulare County forms the largest part. This is in the southern portion of the San Joaquin Valley, and extends to the east over the foothills into the high Sierras. From a sparsely-settled area of large farms, it has steadily developed into one of the important citrus and deciduous fruit-growing sections of California. Intensive farming brought about by an abundant water supply with cheap energy for pumping purposes has resulted in a wide diversity of agricultural products. Fully one-third of the farmhouses in Tulare County are using electricity supplied by the Mount Whitney Power & Light Company, and are on land that in 1900 was regarded as hopelessly arid. The principal load consists of motor-driven pumps, and unlike the great majority of central stations the chief income of the company is derived from irrigation business. The horsepower of motors connected to the system of the company is divided approximately as follows: Agricultural load, 81 per cent; domestic load, 4 per cent; industrial load, 9 per cent; railroad load, 3 per cent; all others, 3 per cent. Load distribution in all of the towns is at 2200 volts, two-phase, with the exception of the city of Visalia, where distribution is carried out on three-phase circuits. Two types of distribution lines are used; one covering the greater part of the distribution system operates at 6600 volts and the other for towns and cities at 2200 volts.

Besides furnishing all of the energy used by the Los Angeles Street Railway Company and by the Pacific Electric Railway Company, which have trackages of 360 and 560 miles respectively, the Pacific Light & Power Corporation distributes energy for commercial and residential uses in Los Angeles, San Bernardino, Riverside, Orange and Ventura counties. Its 150,000-volt line extending from its hydroelectric station at Big Creek in Fresno County to Los Angeles, 241 miles distant, passes through Visalia and the territory supplied by the Mount Whitney Power & Electric Company. What changes will be made in the Mount Whitney system under the new ownership will not become known until the final sale of the property is consummated. The Mount Whitney Power & Electric Company has an outstanding capital of $2,625,000 and outstanding bonds of over $3,110,000.

Progress in International Standardization

Effective Work of the Large British Committee and High Value of Co-operation Discussed by C. le Maistre—Impressions of the English Visitor

THE wide extent of the definite progress which has been made in engineering standardization in Great Britain is not fully understood and appreciated in this country. A review of this movement is made timely by the presence here of C. le Maistre, who has charge of the electrical work of the engineering standards committee of Great Britain and is also the general secretary of the International Electrotechnical Commission.

Mr. le Maistre is returning, on behalf of the British committee, a visit made to England by H. M. Hobart and C. E. Skinner in March of last year on behalf of the standards committee of the American Institute of Electrical Engineers. At that time a conference was arranged in order to bring about more uniformity in the standardization rules for electrical machinery of both countries. The recent conference here in New York has been a continuation of the close co-operation initiated by the London conference and has resulted in materially furthering the work. Tenders invited under the American and British rules will now be practically comparable, a result of considerable importance to the industries of both countries.

During his stay of about six weeks here Mr. le Maistre has visited the principal electrical manufacturing centers in the United States and has also been in Canada where he visited Montreal as well as the Dominion Bureau of Standards at Ottawa. He attended the meeting in Chicago called by the Bureau of Standards in reference to the national electrical safety code and also visited the Underwriters' Laboratories, and will attend the annual meeting of the A. I. E. E., to be held next week in Cleveland, where he will read a paper on "Standardization." Mr. le Maistre discussed, at the special request of the ELECTRICAL WORLD, *the large scope and attainments of the British Engineering Standards Committee. His remarks have a special interest and value for this country at the present juncture in the movement for standardization.*

Sixth in a Series of "Talks in the Industry"

BY FREDERIC NICHOLAS

"LOOKING back to the beginning of standardization in England," said Mr. le Maistre, "it is interesting to recall that the general opinion was held that very little really effective standardization could be accomplished. It is a sharp contrast from that picture that the present comprehensive organization gives. The committee now might properly be called a commission."

The work of standardization in England had its inception in January, 1901, when the council of the Institution of Civil Engineers appointed a committee to consider the advisability of standardizing various kinds of iron and steel sections. At its first meeting the committee decided to recommend that the council invite the councils of the Institution of Mechanical Engineers, the Institution of Naval Architects and the Iron & Steel Institute to nominate members for the committee. Following this enlargement it was suggested in January, 1902, that the standardization of electrical plants should be undertaken and, as a result, the Institution of Electrical Engineers was invited to co-operate in the work.

SUPPORT OF THE GOVERNMENT

Almost from the beginning the movement has been given the moral and financial support of the government, which, of course, is a large consumer of the materials for which standard specifications are prepared. In addition to the home government of England, the governments of India, New South Wales, Queensland, South Australia and Victoria have subscribed to the support of the work. The British Electrical & Allied Manufacturers' Association, the Cable Makers' Association, the Electrical Contractors' Association, the Incorporated Association of Electrical Power Companies, the Incorporated Municipal Electrical Association and the Institution of Electrical Engineers also give direct financial support to the movement. Many municipal authorities which operate electricity departments also contribute toward the expense.

"The completeness of the organization," Mr. le Maistre said, "is indicated by the fact that under the main committee there are more than 100 sectional committees and sub-committees with a total membership of between 600 and 700. It has been stated that this is the greatest private co-operative effort ever made in England. The members of the committee realized when they started that they were embarking on a campaign of education, and they have steadily maintained high standards.

"Sir John Wolfe Barry, K.C.B., whose father built the Houses of Parliament, was the projector of the movement. When the electrical work was commenced in so small a way there was fear that originality and independence would be lost. But the increase in the power and the influence of the movement was rapid as its economic possibilities began to be more appreciated.

"In the electrical industry alone, before the committee began its work, the multiplicity of specifications was a great burden to the manufacturers, especially in cost of tendering. The development of the committee's work has, however, largely remedied this, for its specifications are accepted throughout Great Britain and the Empire by all classes of purchasers, government departments, as well as municipal bodies and corporations generally. Lloyd's Register, Bureau Veritas and other interests of importance are absolutely in accord with the purposes of the committee. Its work is above suspicion from any quarter.

"The form of organization has undergone little change in principle from the beginning. The main committee is practically an administrative body. As recently as two years ago the electrical section was modified considerably and its operation made more effective. It has now a section representing practically every part of the industry.

STANDARDIZATION, NOT CRYSTALLIZATION

"In the movement in England one of the chief aims of the committee has been to insure that standardization does not become crystallization, and to this end all its specifications come up for revision annually. The

point of view is held that standard specifications must be susceptible of development and revision if they are to keep pace with the industry. The strong purpose of the work is to promote interchangeability and standardization of performance, and to avoid any interference with progress and design.

"It should be mentioned that the growth of the electrical section of the movement is due in large measure to the close co-operation of the British Electrical & Allied Manufacturers' Association. Before the organization of that body there was no effective means of obtaining the consensus of opinion of the industry. The Manufacturers' Association has a standardization committee of its own under the able chairmanship of Mr. A. R. Everest, who has worked very hard to promote the success of this work."

Mr. le Maistre spoke with much pleasure of the extremely courteous way in which the American standard committee had received the criticisms offered by the British committee on the American standardization rules, and hoped that at the meeting which was to take place at Atlantic City the British rules would be taken into account by the American committee with a view to his taking back criticism of the Americans which would be of material assistance when the British rules are revised next autumn.

"No one appreciates more than the British committee this genuine effort toward co-operation," he added. "With the specifications which are to be issued, the ratings of American and British machinery will be comparable."

Mr. le Maistre spoke only briefly of the conditions in England arising from the war. "The war has taught us co-operation such as we never dreamed of," he declared.

In discussing his trip to Canada, the visitor expressed gratification that there are signs of closer co-operation between the American and the Canadian committees, and that there is every probability of some of the members of the Canadian committee attending the A.I.E.E. convention.

Co-operation Desirable Here

"Co-operation under one roof is, in my opinion," declared Mr. le Maistre, "a most desirable policy. I am sure that it is especially desirable in a country like the United States, which is so vast in industry and resources that people have to think and act in big terms. Indeed, I am glad to see that a definite movement has now been launched with a view to the establishment in America of a central organization such as we have in Great Britain—a representative American standard committee."

One work which the British committee has done is in connection with the war, a point which has a bearing on the preparedness movement in this country. The committee offered its services to the Ministry of Munitions, and its help has been asked on various occasions by officers of the War Office and the Admiralty. Leslie S. Robertson, the secretary of the committee from its inception in 1900, was made assistant director of production in the Ministry of Munitions Department. He lost his life with Lord Kitchener.

Another work of the committee is the translation into French of the new British standardization rules for electrical machinery. This has been accomplished through the aid of the central office of the I.E.C., and the translation has received the approbation of the president of the French electrotechnical committee.

In speaking of his visit to the various industrial works, Mr. le Maistre remarked that no words of his could adequately express his gratitude for the extraordinary generosity and courtesy he had received from one and all with whom it had been his privilege to come in contact. The genuine kindness shown him would remain the outstanding feature of what had been to him a veritable educational tour. "America is a wonderful country with a grandeur of outlook little appreciated by those who have not visited her shores," he said.

Industrial Plant Substations Costs

The references to figure numbers in the tables on pages 1356 and 1357 of the ELECTRICAL WORLD for June 10 do not check with the figure numbers used with the illustrations. Under Table II reference to Fig. 2 should be omitted and the first line made to read: The installation is rated at 200 kva. Under Table III, Fig. 3 should be changed to Fig. 2. Under Table V, Fig. 5 should be omitted and the first line made to read: The installation is rated at 200 kva. Under Table VI, Fig. 6 should be changed to Fig. 3. Under Table VII, Figs. 7 and 8 should be changed to Figs. 5 and 6, and under Table VIII, Fig. 9 should be changed to Fig. 8.

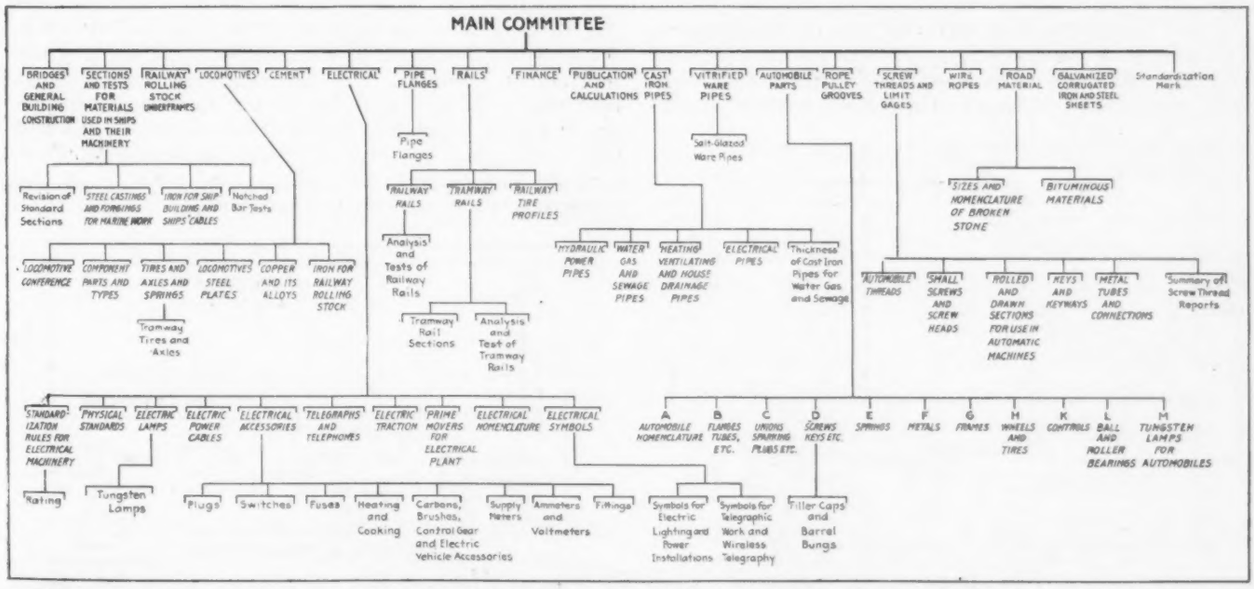


DIAGRAM SHOWING RELATION OF SECTIONAL COMMITTEES, SUB-COMMITTEES AND PANEL COMMITTEES TO THE MAIN COMMITTEE OF THE ENGINEERING STANDARDS COMMITTEE

The Testing of Household Appliances

How the Safety, Efficiency, Economy and Durability of Devices to Be Offered for Sale to Customers Are Investigated by a Large Public Service Organization

By H. A. Cozzens, Jr.

With the great variety of motor-driven appliances and electrically-heated devices now offered on the market, it sometimes becomes desirable to determine which appliances in particular fulfill given requirements of safety, cost, efficiency and durability, so that their sale may be locally encouraged for the most satisfactory development of the residence load from the standpoints of both the electric lighting company and the customer.

The testing of each type of household appliance offered for sale by its various electric shops is now being carried on by one large public service organization in the East, and the methods used in its laboratories for investigating the energy consumption, safety, and construction of these devices, are described in the following paragraphs. The term "testing" in connection with these studies is in a way out of place, for the testing of one of these domestic appliances involves vastly more than a mere determination of its economy and operating characteristics.

The first test of any appliance should be a close examination of the apparatus to insure that it is safe in the hands of non-technical people, and particularly in the hands of the housewife. Many appliances with the best of operating qualities have been rejected in the laboratory above referred to because they fell short of the standards of safety.

After such an examination, the first test made is that for grounds. This test consists of ringing through with a magneto between one side of the cord and the framework of the appliance. It is advisable to supplement this test with a pressure of 600 volts direct current imposed across the same points, selecting various places on the framework. This test shows the appliance to be free from grounds and to have an insulation which will stand several times its rated voltage.

In the testing of commercial appliances the results sought are different from those in tests on other forms of apparatus. The chief concern is the cost of operation. The average housewife contemplating the purchase of a percolator is interested in but two points: (1) the durability, and (2) the cost of operation as compared with the old-fashioned coffee pot on the stove. The fact that the percolator will boil a given number of cubic centimeters of water in a certain number of seconds is of no avail to her. The second test involves the determination of the current taken by the device at the rated voltage. The test is elaborated by securing readings of the voltage and the watts, from which the power factor may be computed.

Design of Test Table and Circuits

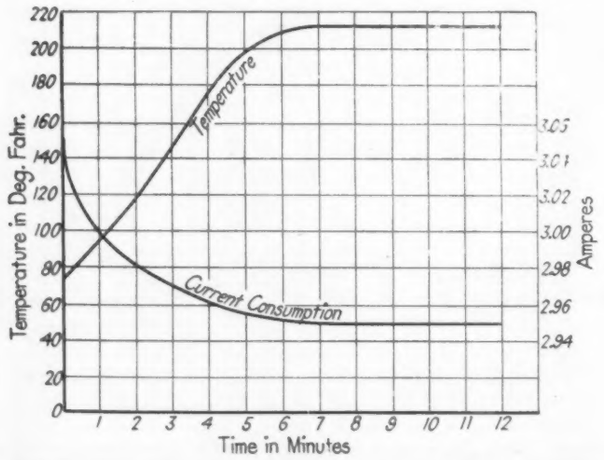
In laboratories where considerable testing of household appliances is done a special table designed for these tests can be advantageously used. The wiring diagram of such a table is shown below. One side of the table is equipped with a receptacle to which the appliance to be tested is connected. In the same circuit are the voltmeter, ammeter and wattmeter, as well as rheostats for regulating the voltage. Short-circuiting switches are provided for instrument protection. On the other side of the table are provided a number of receptacles to which appliances on "life test" may be connected. The table top is made of transite or some non-inflammable material.

The next test is to determine the durability and ruggedness of the appliance. For household devices which nave heating elements, such as electric irons, curling irons, radiation heaters and toasters, etc., the heating element is submitted to a "life test." This test consists of operating the appliance continuously for a certain number of hours. A fair test is to keep the device on the circuit for from 800 to 1000 hours. A few years ago not many elements would stand this test, but with the heating elements manufactured to-day the percentage of failures is very small. Current readings should be taken with an ammeter every 100 hours or so to determine the effect of length of service on the operating cost.

Appliances standing the life test are next dismantled and their heating elements are examined. With a little experience the tester will soon be able to decide on the merits of various types of elements.

Time-Temperature Tests of Heating Appliances

For appliances used to heat water or to provide heat for cooking, a valuable test consists in taking time-temperature readings in conjunction with the regular instrument readings. An accompanying curve shows how such readings are plotted for an immersion-type water heater. Water is drawn from the city mains and put in the glass or container and the temperature recorded. The current is turned on and readings of the temperature and current are taken every minute. The



TIME-TEMPERATURE CHARACTERISTICS OF IMMERSION HEATER

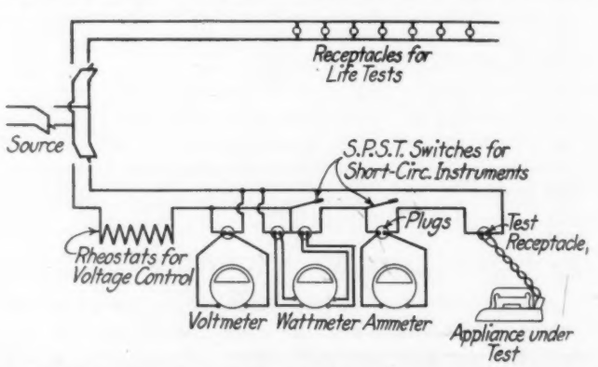


DIAGRAM OF WIRING CIRCUITS FOR APPLIANCE TEST TABLE

temperature curve rises quite rapidly and then follows a straight line along the boiling temperature. The current taken is a maximum at the start, gradually falling off as the resistance decreases.

It is obvious that various results may be obtained depending on the quantity of water used in these time-temperature tests. For small immersion heaters it is advisable to predetermine the amount of water used so that the test results of different heaters may be compared with some accuracy. With percolators and tea urns the capacity of the container governs the amount of the water, so that such appliances having the same capacity can readily be compared as to economy.

With electric ovens and fireless cookers the same relation between the time and temperature may be observed. A sketch herewith shows curves for a fireless cooker having three heats—low, medium and high. A thermometer is inserted in the oven and readings are taken every five or ten minutes until the maximum temperature for that heating position is reached. The heat retention characteristic is obtained by recording the temperatures as they decrease, from the time the current is shut off to the time the oven reaches room temperature. These curves are of value in comparing the heat-insulating qualities of various cookers.

There are now on the market many makes of portable pumps for use in garages. The power taken by these pumps varies with the pressure against which they operate. Another curve reproduced on this page gives the current plotted against the pressure in pounds per square inch. These readings were obtained by gradually closing the valve in the air-delivery hose.

OVERLOAD TESTS ON VACUUM CLEANER

The usual procedure in the testing of vacuum cleaners consists in examining the cleaner for some new feature or accessory. The vacuum cleaner represents probably the greatest development in the line of household appliances. It is remarkable that these refinements come in with every new model. The current taken with the cleaner doing various grades of work with different tools for the sweeping, brushing, blowing and similar operations should be measured. The air delivery on the exhaust side may be ascertained by the use of a Venturi tube, and this figure will give a basis for comparing the fan capacities of the different makes of cleaners. At the present time there are a great number of cleaners on the market, and all have about the same economy of energy consumption so that the greatest attention should be directed at the class of work done, the facility of operation and the practicability of the various "improvements."

With motor-driven apparatus two observations should be made which have a more or less important bearing on the operation of the machine, and also on the circuit to which it is connected. The first is the current taken with the motor blocked. This will give a figure showing the amperes on the circuit if the motor be stalled due to an overload or to some mechanical disarrangement. The other observation is the maximum swing on the ammeter when the switch is closed. This reading represents only an instantaneous load, but is in some cases found to be excessive, sometimes equalling several times the rated current taken of the motor. These readings are valuable in determining whether it is practical to operate the appliance on a house circuit protected by small fuses.

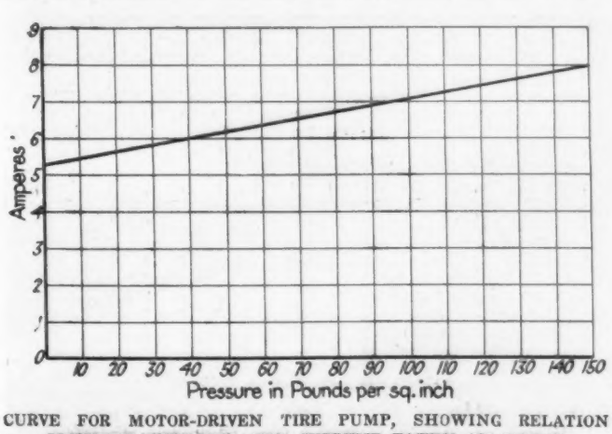
Another point in connection with large motor-driven machines, such as washing machines, involves running the machine for a period of an hour or more, and observing the initial and final temperatures of the motor. Too often much of the manufacturer's ingenuity is spent on the washer, and the motor rating employed is a secondary consideration, the result being that the motor is too small for the work and heats to excess.

STANDARDIZING APPLIANCE TESTS

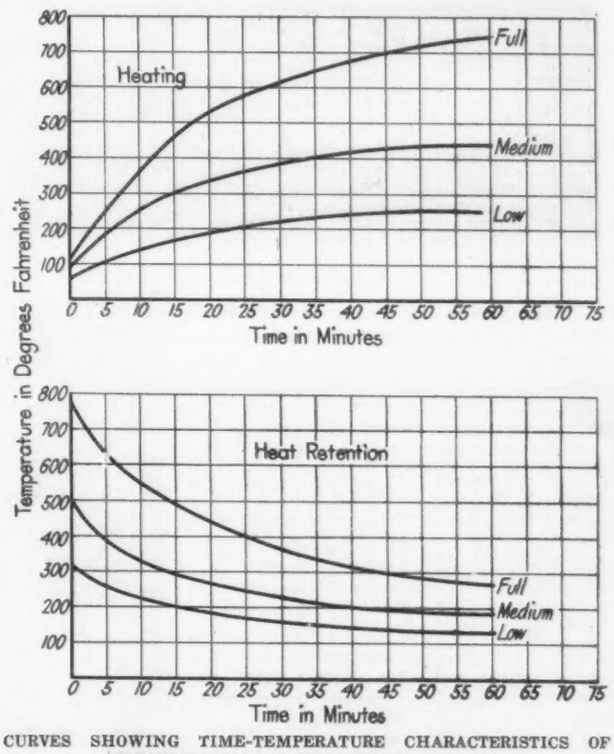
In closing, a brief word of caution should be written about standardization of tests. It is obvious that in all tests there must be some form of standardization, or the investigator would be unable to compare the results obtained from different appliances. With some types of apparatus encountered in power-plant practice this is not a difficult procedure. With household appliances, however, the field is so broad and the uses are so diversified that standardization can be only approximated.

Thus, for instance, with washing machines a relation should be established between the capacity of the machine in gallons and the weight in pounds of the clothes used during the test. In this way a small washer will not be overloaded, and the washer with a large tank tested running light. With vacuum cleaners, it is advisable, when possible, to follow the same routine with each make of cleaner, using a rug kept for such tests.

Tests of other appliances can be standardized only by experience, but the chief aim in every case should be, of course, to duplicate every-day operating conditions.



CURVE FOR MOTOR-DRIVEN TIRE PUMP, SHOWING RELATION BETWEEN PRESSURE AND CURRENT TAKEN BY MOTOR

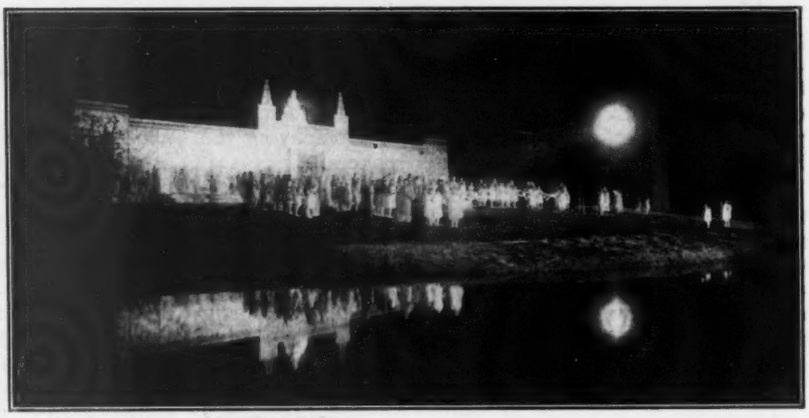

Heating
Full
Medium
Low
Temperature in Degrees Fahrenheit
100 200 300 400 500 600 700 800
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75
Time in Minutes
Heat Retention
Full
Medium
Low
Temperature in Degrees Fahrenheit
100 200 300 400 500 600 700 800
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75
Time in Minutes

CURVES SHOWING TIME-TEMPERATURE CHARACTERISTICS OF ELECTRICALLY HEATED FIRELESS COOKER

Adding Hours to Summer Days for Outdoor

The clock-golf course of the Fort Mitchell (Ky.) Country Club pictured at the left is lighted by six 750-watt Mazda lamps inclosed in steel reflectors and mounted on pipe standards. The 18-ft. cross-arms suspend the lamps at a height of 14 ft. above the ground. A uniform intensity of about 3 foot-candles is maintained over the entire course, irrespective of the location of the holes of the clock and court-golf courses.

"The Pageant of Newark," depicting the history of New Jersey's great industrial center since the landing of Robert Treat 250 years ago, was presented last month with the aid of flood-lamp projectors as one feature of the May-to-October celebration now being held by the merchants and manufacturers of the city. The scene illustrated herewith was lighted by forty-five projectors, each containing a 500-watt Edison Mazda gas-filled lamp. Most of these projectors were mounted behind the audience, but several powerful lamps hidden in the wings aided in lighting the stage setting.

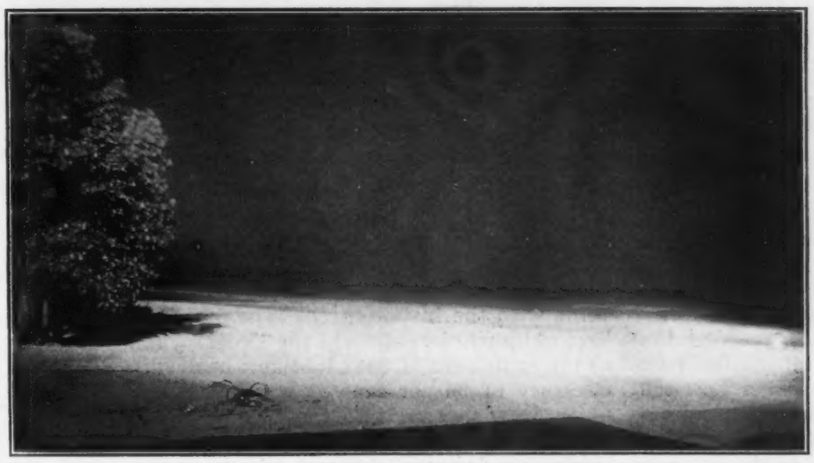


The football practice field at the Chicago University lighted by two 1000-watt projector units. The lamps are mounted at a height of 60 ft. on top of the gymnasium roof and are situated about 150 ft. from the field. Both Coach Huff of the University of Illinois and Coach Stagg of Chicago University have utilized flood-lighting in teaching football to their squads. This use of electric light has proven of particular value in getting in more hours of practice after university classes are over. The 'varsity elevens easily execute some of the most difficult plays under this artificial illumination.

Night lighting of tennis courts by the "overhead" and "side-line" methods are illustrated in this picture. In these courts at Gwynn Falls Park, Baltimore, Md., the left-hand court is lighted by four 1000-watt Mazda C lamps, suspended over the center line of the court, while the right-hand court is equipped with twelve 400-watt lamps along the side lines. The latter court appears to be the favorite with the local players. However, the center line method is recommended as being more economical when groups of adjacent courts are to be lighted. Tennis is a strenuous game, and electric illumination makes the tape-lined courts available during those delightful hours of the evening when grateful relief is afforded from the heat and glare of the day.

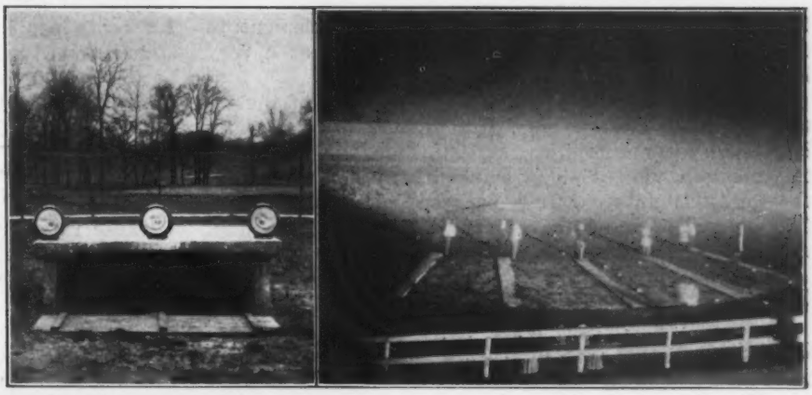
Recreations—

Applications of Electric Light that Enable Busy Day Workers to Enjoy Golf, Tennis, Bathing, Trap-Shooting and Outdoor Spectacles During Cool Hours of Summer Evenings



One of Chicago's municipal bathing beaches lighted over an area 800 ft. long by 400 ft. wide, by ten 1000-watt projector lamps. The units are situated on a tower 65 ft. high, at one end of the beach. Even the intake crib in the center of the picture, which is three-quarters of a mile from shore, was clearly visible by light from the projectors, in spite of the fact that no lamps were focused on it. Such electric flood lighting enables the great work-a-day public to enjoy its bathing beaches to the fullest at the close of long, hot days of toil, with the assurance of safety to young and old under the watchful eyes of the life guards.

Projectors for trap-shooting illumination are shown in the daylight picture. In one shoot held by the light of these lamps ninety-nine of a possible 100 clay pigeons were broken. The night picture shows trapshooters in action under the illumination of six 1000-watt projectors mounted on the clubhouse roof behind the shooters. With no changes in the setting of the traps, or in the color of the "birds," the shooters made night scores equivalent to those made by daylight.



The Sheepshead Bay Military Tournament held this spring within the grounds of the famous New York City race track of that name, involved the lighting of an area 1500 ft. by 1800 ft. (see picture below). The equipment comprised 115 flood-lighting projectors, each equipped with a 500-watt Mazda C concentrated-filament lamp. The projectors were mounted on the grandstand about 50 ft. high on small platforms in front of the second tier of boxes. All lamps were focused for maximum concentration, except those at the ends, which were arranged to give a wide beam to light the approach of troops.

The illumination of the great 1500-ft. by 1800-ft. inner field during the Sheepshead Bay military tournament was very pleasing and effective. In looking over the field from the grandstand there appeared a great, softly-lighted area, surrounded by darkness. No source of light appeared in the line of vision, but the intensity on the field was sufficiently high so that even the khaki-uniformed soldiers lying down in the skirmish drills could be distinctly seen. The area illuminated was one of the largest ever flood-lighted.

Domestic Water Heating by Electricity versus Gas

Electrical Energy at 1.3 Cents Declared Comparable to Dollar Gas—How Addition of Water Heater in Dwelling Where Electric Range Is Installed May Double Company Income

BY R. L. WEBB

The cost of heating water by electricity for household use is not as great as many customers and some central station managers have come to believe. It is more than likely that the cause for dissatisfaction among consumers about the cost might be almost entirely removed if they did not expect to use electricity the same as they are accustomed to use gas, but the root of the trouble lies with the central station men themselves, for they must show the consumer how the cost of the methods of heating water compare, and explain what the actual costs are when electric water heating is properly done. It is greatly to the interest of the central station to do this because electric water heating can be made a very desirable supplement to the electric range load, even when assumed at a very low rate.

The writer recently made an investigation of the requirements of electric hot-water heaters in small families, and after compiling statistics on this phase of the question, visited all of the central stations west of the Rocky Mountains. It is proposed to sum up in the following a view of the subject based on this study, which has extended over a period of eight months.

COMPARATIVE EFFICIENCY OF HEATERS

The first step in the study of the situation was to find out the exact cost of heating water by gas. Two general types of gas heaters were found to be in use: (1) The copper-coil circulating gas heater connected to the range boiler, usually in the 30-gal. size, and which is generally sold by gas companies for $17 installed; and (2) the instantaneous-type gas heater, which costs more than $100. The latter is operated by a thermostat and pilot lamp. Both of these heaters were carefully tested.

The efficiency of the copper-coil type was found to be 50 per cent, and that of the instantaneous type 60 per cent. The latter value did not include the gas consumed by the pilot lamp. Several makes of electric circulation type heaters were also tested and these were found to be about 95 per cent efficient.

From these data the following comparison between electricity and gas has been made: With gas of 600 lb.-Fahr. heat units per cubic foot, costing $1 per 1000 cu. ft., 1 cent's worth of gas contains 6000 heat units. With the copper-coil gas heater of 40 per cent efficiency, 2400 heat units will be delivered into the water for 1 cent, while with the instantaneous type 60 per cent, or 3600 heat units will be delivered for 1 cent. Taking 1 kw.-hr. as the equivalent of 3412 lb.-Fahr. heat units, and at an efficiency of 95 per cent, it was found that 3200 heat units are delivered into the heater per kilowatt-hour consumed. Therefore, to keep the cost of heating by electricity down to the cost of gas heating with the copper-coil heater, energy must sell for 3200/2400, or 1.3 cents per kilowatt-hour. Comparing with the instantaneous type of gas heater, the rate would have to be 3200/3600, or 0.89 cent per kilowatt-hour. From this data Fig. 1 has been plotted, comparing the two gas heaters with different rates per kilowatt-hour for electricity.

COMBINATION RANGE AND WATER-HEATER SERVICE

These rates for electricity appear very low, so a way to justify them was sought. It seems to be the consensus of opinion of the various companies visited that the average consumption of energy per range is 100 kw.-hr. per month; that the average total range load is 5 kw., and that the diversity factor is about 5. This would give, at a 3-cent cooking rate (100 kw.-hr. at 3 cents) $\frac{\$3.00}{5\text{ kw.}} \times 5$ diversity factor, $3 per kilowatt peak load, or $36 per year. As the range is not in use more than four hours per day, the remaining twenty hours could be used to advantage in heating water. This would not require any additional investment on the part of the central station company, and by using a well-insulated storage tank this four-hour period can be adequately supplied from storage.

A careful investigation was made to find the amount of hot water required in families for baths, washing, etc., using different sized heaters and tanks. Recording thermometers and water meters were used and it was

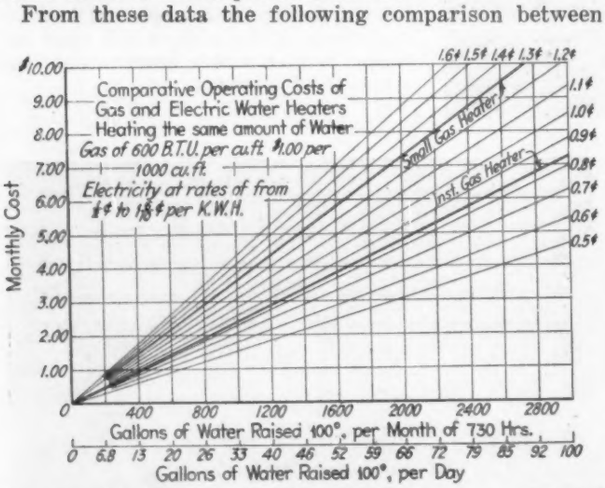

Comparative Operating Costs of Gas and Electric Water Heaters
Heating the same amount of Water
Gas of 600 B.T.U. per cu.ft. $1.00 per 1000 cu.ft.
Electricity at rates of from ¼¢ to 1⅝¢ per K.W.H.
Small Gas Heater
Inst. Gas Heater
1.6¢ 1.5¢ 1.4¢ 1.3¢ 1.2¢
1.1¢ 1.0¢ 0.9¢ 0.8¢ 0.7¢ 0.6¢ 0.5¢
Monthly Cost
$10.00 9.00 8.00 7.00 6.00 5.00 4.00 3.00 2.00 1.00 0
400 800 1200 1600 2000 2400 2800
Gallons of Water Raised 100°, per Month of 730 Hrs.
0 6.8 13 20 26 33 40 46 52 59 66 72 79 85 92 100
Gallons of Water Raised 100°, per Day

FIG. 1—COMPARISON OF COST OF ELECTRIC WATER HEATING AT VARIOUS RATES FOR ELECTRICITY, WITH COST OF HEATING BY GAS AT $1 PER 1000 CU. FT.

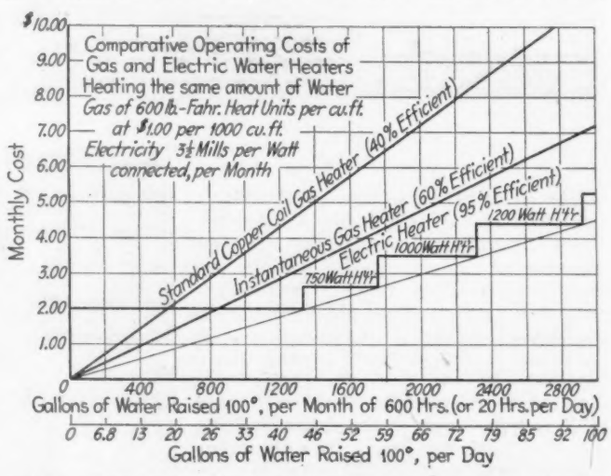

Comparative Operating Costs of Gas and Electric Water Heaters
Heating the same amount of Water
Gas of 600 lb.-Fahr. Heat Units per cu.ft. at $1.00 per 1000 cu.ft.
Electricity 3½ Mills per Watt connected, per Month
Standard Copper Coil Gas Heater (40% Efficient)
Instantaneous Gas Heater (60% Efficient)
Electric Heater (95% Efficient)
750 Watt H'ter
1000 Watt H'ter
1200 Watt H'ter
Monthly Cost
$10.00 9.00 8.00 7.00 6.00 5.00 4.00 3.00 2.00 1.00 0
400 800 1200 1600 2000 2400 2800
Gallons of Water Raised 100°, per Month of 600 Hrs. (or 20 Hrs. per Day)
0 6.8 13 20 26 33 40 46 52 59 66 72 79 85 92 100
Gallons of Water Raised 100°, per Day

FIG. 2—COMPARATIVE COSTS OF OPERATING GAS WATER HEATERS, AND 750-WATT, 1000-WATT AND 1200-WATT ELECTRIC HEATERS

found that 10 gal. of water at 160 deg. Fahr. per person per day is amply sufficient. This can be supplied by a 750-watt heater for the average family of about five persons. By the use of a double-throw switch so connected that when the range is in use the heater is cut off, the demand could never be greater than that of the range. This double-throw switch was connected, in the case of one company, so that while the energy for the range passed through the meter, that for the heater was taken off outside of the meter. This enabled a number of companies to give a flat monthly rate for water heating.

Several companies have a rate of 3.5 mills per connected watt of water-heater capacity per month, using a double-throw switch for the range installations. On this rate the minimum cost was $2 per heater per month. Under this arrangement the cost amounted to $2.63 per month for a 750-watt heater. This practically doubles the income from the range business, for it adds $31.50 per year for water heating to the average range income of $36 per year, making a total of $67.50 per year without any increase in investment on the part of the central station. In Fig. 2 this rate is compared with the cost of heating water with the two gas heaters.

What to Do in Fan Time

The Dealer Must Prepare in Advance for the Hot-Weather Rush—Making Use of the Selling Helps Furnished by Fan Manufacturers—The Five Classes of Fan Buyers

BY EARL E. WHITEHORNE

THERE is just one thing to do in fan-time—sell fans.

It is a curious habit of the mind that makes a man refuse to learn and discount the beguiling tricks of the weather. Each year it gets between the local dealer and his fan campaign and costs him money, for summer seems long in coming and he waits and is not ready when the hot wave brings its opportunity. Yet everything is provided on a silver platter nowadays, and no dealer need fail to do a good fan business if he will. But fan time is the time to sell fans, and sell them hard right then.

A fan campaign is temperamental. It refuses to be tied down to the calendar. It must be taken hot or not at all—and when you come to think of it—why not?

ON BEING "PREPARED"

It is hard for most men to hold the proper necessary mental attitude toward an "outlaw" campaign of this kind, the point of view that recognizes that behind the relative appeal of all the things he might do—the pressing routine work, the long-deferred important job, the personal-hobby line, or the fan campaign that wants to upset every schedule—is the unit value of a dollar bill. For, after all, what does it matter what he gives his mind to during any one month if he but spurs his business on and masses the greater profits. When fan-time comes, no other normal selling opportunity can offer contractor or dealer such a market for good selling, and since it will not wait convenience every ounce of energy and enthusiasm should be put into selling fans whenever summer's coming shall point out the date. Right at that time there actually is nothing else as valuable, as necessary and as promising in quick returns, and why should any part of it be negligently thrown away? Behold, the prize is ready for the plucking.

The supporting service that is generously provided nowadays by fan manufacturers arms every eager dealer for success if he will utilize it. He need not fear for the results because of his own inexperience or lack of time for making ammunition. The manufacturer will put the power in the dealer's window, in his letters, in his newspaper ads, and in his salesmen's mouths for him if he will but supply the purpose and the stimulating force of an enthusiasm applied day after day to selling fans one after another for ample profits. Surely this is meeting him half way—and more. It is a pity that so many local men will not prepare and then bestir themselves a-plenty when the hour comes.

Cream rises, but there is far more than the first day's skimming in a pan of milk, and there is more for every man in selling fans than just the counter sales that come heat-driven to your store. For everyone who rises to the surface in the flood of cream, there are a dozen others ready to buy but not to come and clamor, other dozens who will be responsive to a selling impulse to a varying degree, and in the aggregate these present the greater opportunity. To tap it needs publicity and follow-up. The dealer must be ready when fan-time comes.

FIVE CLASSES OF "PROSPECTS"

This being ready is not half as complicated as a busy man is apt to think it is going to be. There are only about five places to sell fans—the homes; the stores; the offices; hospitals, schools and other institutions, and the shops and factories. In these five places they will need fans when hot weather comes, and they will know well that they need them. In countless cases they will buy them if somebody urges them with proper selling impulse. But the question is: where will they buy them—from what dealer? There is the whole problem.

The man who would sell fans must let the people know he sells them. First by sending out a message to all the people that he knows—his customers upon his books—that he is selling fans and that they should buy them. Then spread this message further through the mailing out of advertising matter that the manufac-

A PRIZE-WINNING EXHIBIT WINDOW THAT ATTRACTED THE INTEREST OF NEW ORLEANS FAN BUYERS

turer is eager to provide, by a clear call from the newspapers through display ads at the right time. They are most potent reminders, while day by day the windows of your store are reaching strangers every hour and driving home this mental calculation: "Everybody nowadays has an electric fan. I ought to have one, too. They sell them here." And then behind all this comes the great urgent demand for personal selling when the heat comes hard, by telephoning people whom you know, by canvassing big offices where fans are sold not only for their comfort, but for efficiency, to those stores where good air builds up business, and the merchant knows it, and to those factories where it can be demonstrated that both breeze fans and exhaust fans should be utilized for the same good reason that steam heat is used in winter time—to make the workers comfortable that they may work the faster and that they will make fewer mistakes.

In fan-time, I say—those weeks when the first great burden of the heat assails us all—there is nothing as important to the dealer as this opportunity. The problem of how to sell them is a simple one—he knows how. There is just one point that is indefinite, the question of just which week the campaign should begin. It is a matter of preparedness, and every contractor and dealer who has not yet secured an ample stock of fans and ample advertising matter, and decided to whom among his five classes of prospects he will make his hard drive, had better do it now, for he will find that the other work which he may handle at any time can be more profitably held up. There is just one time to sell fans—that's fan-time.

Figuring Expenses and Profits in Contracting

How the Electrical Contractor Can Estimate Probable Costs of His Business in Advance —Practical Points Concerning Profits, Abstracted from Paper Read Before Missouri Electrical Contractors' Association

By O. G. Pack
Secretary Kansas City Electrical Construction Company

THE man who contemplates entering any business for himself, declared Mr. Pack, will find it useful to consider first how much his own services are worth to himself—in other words, he should learn the market value of his services to a going concern, considered without financial investment on his part. Continuing, Mr. Pack, who is secretary of the Kansas City Electrical Construction Company, pointed out that no man can afford to enter into business for himself if the prospective financial returns, exclusive of a reasonable return on the investment required, are not greater than the salary he might earn.

"If, for instance," said Mr. Pack, "I contemplate going into the electrical contracting business, and am capable of earning $150 a month as estimator for some reliable contracting firm, it would be foolish for me to enter business for myself unless I am reasonably sure the business will pay me more than $150 per month. Furthermore, a capable man who enters the contracting business and who does not figure his services as high as $150 a month is making a mistake, and had far better continue working with tools, thereby benefiting both himself and the electrical business as a whole. I insist that this is a very reasonable wage for the smallest of electrical contractors to figure their services worth, and submit the following evidence:

The Contractor Should Not Forget His Own Salary

"We have, for example, in our own employ at least six men who are not capable of conducting a contracting business and who are only workmen using tools, but who have earned from $1,200 to $1,890 a year over a period of three years. We have six men in our employ whose wages have amounted to as much as the figure above mentioned. We believe that if the man with only the knowledge and ability requisite to perform the physical labor of making electrical installations is entitled to wages such as those mentioned, then certainly the electrical contractor, who has the knowledge of getting and operating the business, in addition to the skill his employees have, is entitled to receive compensation for such knowledge and ability.

"I doubt that there are many electrical contractors who have been able to draw more than this amount out of their businesses without seriously inconveniencing their bank accounts. The point I am trying to make is to impress on all contractors that their services are worth at least this much, and that this matter of their own salaries is the first item they must figure as an overhead expense in arriving at their cost of doing business.

Figuring the Yearly Budget

"The nature of the electrical contracting business is such that one should estimate it on a yearly basis, owing to the long time it takes to complete some installations. One of the first things for the electrical contractor to do on starting the fiscal year is to make up an estimated budget of what his operating expenses are expected to be during the coming year. We have found that the following items must be figured in as an overhead expense. These are items that most electrical contractors have, whether they figure them or not:

Salary; management; office and stockroom salaries, and general expense, including rent, teelphones, light, fuel, power, association dues, water, ice, towel service, occupation and merchant's licenses, watchman's services, fire and liability insurance, advertising, taxes, stationery and office supplies, interest, allowances (adjustments on accounts receivable), overhead labor (that is, non-productive labor), automobile expense, and miscellaneous expense sufficient to cover items not itemized, as based on previous experience.

"Having completed a yearly estimate, we find it expedient in closing our books each month to compare the actual business obtained with the monthly expense. This gives us accurate knowledge every thirty days as to just how we stand and whether we are making or losing money. We have made a chart of the following items, which we know to be expense items and which must be figured against each month's business. We do not allow our books to be closed at any time without turning to this chart and checking these items as having been figured against gross profit for the current month's business the following items:

Salaries	Water service
Rent	Watchman
Light	Ice
Fuel	Taxes
Phones	Association dues
License	Interest and discount
Insurance (fire)	Stationery and office supplies
Insurance (liability)	
Laundry service	

"After completing the estimated budget of expense for the year, the next step is to determine the volume of business that can be gotten and handled without added expense. This must be based on previous experience. Next determine what percentage it will be necessary to figure on this volume of business to cover overhead expense.

"The matter of profits is a vital end of the business. What is the use of carrying on contracting if the profits, the whole purpose for operating the business, are lost in bad methods of figuring prices. All expenses are going to come out of the gross profits, whether or not they are put down as part of the cost of doing business. If a man pays out $50 a month for rent, he will not find it to his credit in the bank at the end of the year, even if he does not charge it as expense. The same rule applies to every kind of expense in the business. Every one of the items mentioned in this budget is an expense, whether you charge it as such or not. I believe it is far better to err on the side of too liberal charging of expense, so that one may find an unaccounted-for balance in the bank at the end of the year, than to find a puzzling deficit caused by not charging up all your expenses. The deficit may disable you just when failure to pay a bill means bankruptcy.

PRICES THAT WILL EARN PROFITS

"Just for example, let us say your fixed overhead expenses are going to be $2,500 this year, and that you are reasonably sure that you can secure and handle a volume of $10,000 worth of business; then your overhead is 25 per cent of the selling price. You know that the percentage of this expense is figured on the gross business, but do you realize also that a percentage of the gross business is more than the same percentage of the estimated cost?

"Most contractors figure their contract price for doing a certain piece of work by adding what is really a percentage of the selling price to the cost price. This mixing of methods is what helps the contractor to a loss. Where the cost of doing business is 25 per cent of the total volume of business, some contractors merely add 25 per cent to their cost of labor and material, which is wrong. If you think you are adding sufficient to cover your overhead expense on this basis you are making a big mistake. Now, if you are asked to bid on a certain piece of work and you figure the actual labor and material cost to be $60, what should you get for the job to net you your overhead of 25 per cent, plus 10 per cent profit? We will say your selling price represents 100 per cent, your cost of doing business 25 per cent, and that you desire a 10 per cent profit. This makes a total of 35 per cent which, deducted from the 100 per cent, leaves the actual cost of labor and material represented by 65 per cent of your selling price. If $60 represents 65 per cent of your selling price, you should receive $92.30 in order to make your overhead of 25 per cent, plus 10 per cent profit. Your profit is to come out of the selling price, and therefore should be figured as a percentage of this.*

"I do not believe that a contractor can afford to estimate his profit at less than 10 per cent on any job the contract price of which is $1,000 or less, or less than 5 per cent on installations the selling price of which is more than $1,000. The unforeseen obstacles are so numerous and great that unless you figure these percentages for profit, you are likely to find, when the job is complete, that you have done the job for very little or no compensation, so far as your business as a contractor is concerned.

"Let all of us contractors study our cost of doing business, and when we know what it is, let us not be backward about trying to get a price for our work that will cover it and leave a fair return on the investment.

"There are contractors in our own vicinity who now know what their cost of doing business is, but they are forced, on account of some other well-meaning contractors not knowing their cost of doing business, to take work for less than labor and material cost plus overhead expense, in order to make a proportion of their expenses. This condition, we hope, is only temporary, and we look anxiously forward to the time when they can get their volume of business at prices which they will not be ashamed of."

---

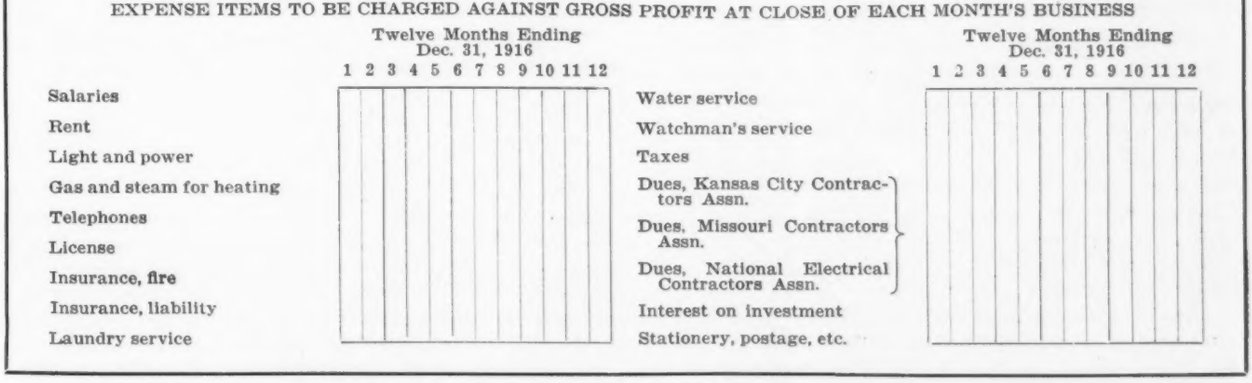
*Too many contractors, points out Mr. Pack, figure their selling prices in the following fashion, which is wrong:

Time and material cost	$60.00
Overhead expense (25 per cent)	15.00
	$75.00
Profit, 10 per cent	7.50
Selling price	$82.50

The method of computing selling price recommended by Mr. Pack gives the following result:

Time and material cost = 65 per cent of selling price	= $60.00
One per cent of selling price	= $0.923
One hundred per cent of selling price	= $92.30

EXPENSE ITEMS TO BE CHARGED AGAINST GROSS PROFIT AT CLOSE OF EACH MONTH'S BUSINESS



A REMINDER CHART THAT COVERS ITEMS OF THE CONTRACTOR'S OVERHEAD EXPENSE TOO OFTEN OVERLOOKED

On the first of each month, before closing his books for the preceding thirty days, Mr. Pack turns to a reminder chart like that reproduced above and checks over each item to make sure that proper allowance has been made for all overhead costs in figuring the gross profit for the current month.

To Build Electric-Range Business

Suggestions for the Planning of the Campaign—Winning the Salesmen to the Electric-Cooking Idea—Demonstrations the Best Form of Advertising

By J. B. Crawford
New-Business Manager Wisconsin Gas & Electric Company, Kenosha, Wis.

"IS electric cooking really practical?" "Can this load be developed sufficiently to make it worth while?" These are two questions that a good many central station men are asking themselves these days. The answer to the first is simply "Yes." Electric cooking is the ideal method—safe, clean and quick, and, as in the case of the electric iron, the housewife who once learns to use an electric range does not care to part with it. And so the sale of electric ranges is increasing by leaps and bounds, for the ranges on the market to-day are entirely practical and a success in every respect. Anyone who is skeptical on this point should give the range a trial in his home, and it is safe to say he will promptly be convinced.

The Matter of a Cooking Rate

The answer to the second question is not so easy. It depends largely on the rate established for this class of service, on the service rendered, on the minimum charge, and on the manner in which the cooking campaign is planned and executed, and every one of these important factors should be considered and determined before any company begins the work of building up a market for the electric range.

In these days, when rates for power and lighting are very generally based on the maximum demand, the tendency is to make a demand rate also for cooking, but in my opinion if a simple rate—a straight 3-cent rate, for instance—is adopted at the outset it will be a big help to the new-business department. The first question of the prospective consumer is always, "What will it cost me per month to operate the electric range?" and the more simple the rate the easier it will be to explain. It is interesting, however, to compare the earning power of the two rate systems, and the following figures are reckoned respectively on a straight 3-cent rate and on the demand rate recently adopted by one of the large utility companies, based on a net rate of 10 cents for the first 10 kw.-hr. consumed in any given month and 2½ cents for all in excess. If we assume an energy consumption based on one kilowatt-hour per person per day, we have:

Number in Family	Kw.-Hr. per Month	Cost Under Demand Rate	Cost Under 3 Cent Rate
2	60	$2.25	$1.80
3	90	3.00	2.70
4	120	3.75	3.60
5	150	4.50	4.50
6	180	5.25	5.40

Such a comparison points strongly in favor of the demand rate because it permits the central station to earn a higher return upon the capital invested in serving the average family.

The Minimum Charge

In the light of general experience, the matter of the minimum charge is more easily disposed of. A dollar per month has been considered too low for this class of electric service, and $2 has been found to be too high; moreover, there are certain objections to a monthly minimum charge—such as the obligation on the part of the consumer to pay the charge when the range is not in use during certain months. The minimum charge of $24 per annum recently adopted by several large companies would seem to offer a satisfactory solution of this question, the idea being to charge the consumer for only the amount of energy he uses, with the understanding, however, that he must use at least $24 worth within the year.

Service First—Then a Plan

Naturally, efficient and uninterrupted service must be rendered, for if the proper voltage is not maintained, or the "juice" goes off while the Sunday dinner is being prepared, electric cooking will condemn itself irretrievably. The popularity of the electric range must be built up by demonstration, education and the satisfaction of every customer, and the proper planning of the work is most important, for a campaign of this kind should not be entered into too hurriedly.

Having established a cooking and heating rate, the next step is to determine the amount of money that it is feasible to spend in advertising and conducting the campaign. This cost should include the salaries and expenses of all salesmen and demonstrators, as well as an amount to be spent upon free demonstrations at churches, clubs, societies and fairs, and the plan should include a special advance campaign to arouse the interest of all employees.

In conducting such a cooking campaign last year, the writer made an effort to induce as many employees as possible to purchase an electric range, and we were fortunate in getting the range manufacturers to offer a reduction of 50 per cent from list prices to all employees who would purchase an electric range within a specified time. As a result, in several of the towns where the company operates the majority of the employees in these towns were already using their own electric ranges when the campaign proper started, and a greater percentage of ranges were sold in these towns than in territory where the salesmen themselves were not actually cooking by electricity in their own homes. The proper organization of the sales force is vital to success. How many salesmen can you use to advantage? Shall they be paid a straight salary, or a salary and commission? How can commissions be handled through the various departments of the company so as to avoid delay? Shall a daily sales report be required? These are questions that will come up, and it is well to settle them in advance.

What Kinds of Advertising?

In the actual work of exploitation such advertising as newspaper announcements and displays, moving-picture slides, monthly-bill "ads," and descriptive, educational booklets will be found necessary and profitable for awakening interest in the subject of electric cooking, but the actual selling will be done through demonstration.

The first demonstration given in the campaign already mentioned took place in the district office at the regular superintendents' monthly meeting. Eighteen superintendents and salesmen were present, and after a short preliminary talk were asked to seat themselves in a semicircle and watch their dinner being cooked. The salesman representing the manufacturer cooked the meal on one large-sized electric range in the office, where it was served at noon. After dinner a general discussion took place, and it is needless to say that this meeting did more to arouse the interest and enthusiasm of our

men than any amount of talk or figures. And it is just so with the public.

In one of our principal towns, in spite of the fact that we had advertised extensively, it seemed impossible to arouse any interest in electric cooking. One day I noticed in the local newspaper an item stating that the Woman's Club was planning to give a big supper in the near future, the proceeds of which would go to charity. The Woman's Club of this town was very active, and was composed of a large number of influential women, so we decided this was our opportunity, and we wrote to the club inviting them to make this an Electric Luncheon, and offering to provide the range and current without charge. Our offer was accepted and the demonstration proved to be a great success, resulting in the sale of about twenty ranges to residence users.

The first range sale is usually the great stumbling block, but if one satisfied consumer can be obtained the rest come more easily. In one town, for instance, our men tried very hard to sell the first range, but without success. Finally, one prospective customer said that he would buy an electric range if we would take his gasoline range off his hands. We took this gasoline range and displayed it in our window, "For Sale Cheap —Replaced by an Electric Range." This exhibit itself resulted in a number of sales. In short, the secret of range selling is to win customers one by one by actual demonstration and by educating each new customer in the economical use of the range, so that his bills will not be unreasonably large.

A Portable Transformer Outfit that Aids in Producing the "Movies"

Electrical Requirements of Photoplay Production, Now an Important Industry of Southern California—Lighting Equipment for After-dark Photography Developed by Santa Barbara Gas & Electric Company

BY S. M. KENNEDY, SECRETARY

THE production of photo plays for the "movies" has become an important industry in southern California. The American Film Company, a leading producer of motion pictures, has a large studio in Santa Barbara, which city, because of the many attractions of its residence streets and environs, is especially adapted to serve as the setting for motion pictures. The "outside work" of the film company is consequently very important, and requests to the local electric company for temporary lighting service at various points, are many and frequent. The locations at which the film company may take pictures are in many directions and at distances varying from 1 to 15 miles. The hanging of transformers and setting of poles for a job lasting only a few minutes was found to be expensive and troublesome, but W. E. Boden, electrical superintendent for the electric company, has developed a portable substation which has solved the problem.

THE TRANSFORMER WAGON, HAULED BY AUTOMOBILE TO THE SCENE OF THE PHOTO-PLAY. TWO HUNDRED FEET OF CABLE ARE CARRIED ON THE REEL

The transformer wagon, which is towed by automobile to any location required carries two 25-kw. 1100/2200, 110/220-volt transformers, banked together

THE LAMP EQUIPMENT AND SOME OF THE MOTION-PICTURE PLAYERS

THE TRANSFORMER WAGON "ON THE JOB"

in a multiple three-wire secondary. Under the seat of the wagon is a box lined with asbestos in which are mounted two 2500-volt inclosed primary cutouts. Primary connections are made from this point, using 2200-volt cambric-covered wire. The primaries enter the box through 1½-in. pipe, the cables being taped together with oiled linen tape, with a covering of Manson tape for extra protection. The insulation is considered absolutely safe, fully protecting operators and public.

A 6-in. by 6-in. Oregon pine timber is used for a pole. This pole is provided with a removable splice joined together with iron loops, which may be easily and quickly removed and replaced. The pole is of sufficient height to give a clearance of 20 ft. at the point of connection to primary conduit pipe. One joint of fiber tubing is used for protection of the primary conduit pipe where this enters the box on the wagon. The transformers are well insulated from all metal parts of the wagon, and the metal parts of the wagon are grounded when in operation, by means of a connection to a water pipe or by a ground cone. On the secondary side of the transformers there is installed a 24-in. by 36-in. ebony panel. On this panel are mounted the meter, current transformers, and a 200-amp. three-wire fused knife switch. The current transformers used are of 300 to 1 ratio. On the rear of the wagon is installed a wooden reel which contains 200 ft. of three-wire 1/0 R.C. cable taped together; one end being brought out through the reel so that the operating switch may be attached at any required distance up to 200 ft. This makes it possible for the picture company to carry the cable to any part of the grounds or building, where it may wish to operate.

The matter of safety has received first consideration in the construction of this substation, and it is surrounded with all details for the protection of those connected with its operation. The film company considers the availability of the substation a great asset. The wagon has recently been moved a distance of 2 miles and the substation connected ready for use in a little more than one hour's time. Under former conditions this change would have meant half a day's work for a gang of men. The motion pictures taken since this substation has been put into service are reported to be eminently satisfactory.

Electric Drive in Clay Product Manufacture

Motor Sizes and Energy Consumption for Various Machines Employed in Brick and Tile Making—Characteristics of Loads and Selection of Types of Motors Best Suited to Conditions of Operation

BY NORMAN G. MEADE

A LARGE variety of motor applications are employed in the manufacture of clay products. These include brick machines, cutting machines, pumps and fans, excavating shovels, dry pans, pug mills, etc. To illustrate more fully the applications of motor drive in the clay-product industry a brief outline of the manufacturing processes is essential. The principal products in this industry are building, fire and paving bricks and tiles for all purposes. In some plants front bricks for building purposes are machine-made with one operation, but repressing is still used to a large extent after machine molding.

In general, the process of manufacture consists of molding, drying and burning. Molding machines are of several classes intended respectively for use with soft mud, stiff mud and dry clay. Soft-mud machines are generally used by small brick-making plants and consist of an upright receptacle containing a shaft with curved arms at the bottom to force the clay into press box molds. The molds are fed automatically under a press after being filled and are moved forward to delivery tables. Stiff-mud machines force the clay through dies by a plunger or auger into a continuous bar, which is cut into bricks by parallel wires or by an automatic cutter. Some molding machines combine a vertical pug mill with revolving arms which force the clay down into molds around the edges of a horizontal revolving table. In the dry-machine process the clay is pulverized, screened and fed from a hopper, through tubes into the molds where it is pressed from above and below. Bricks thus formed are very dense but not well united and must be dried before burning.

TYPES OF MOTORS RECOMMENDED

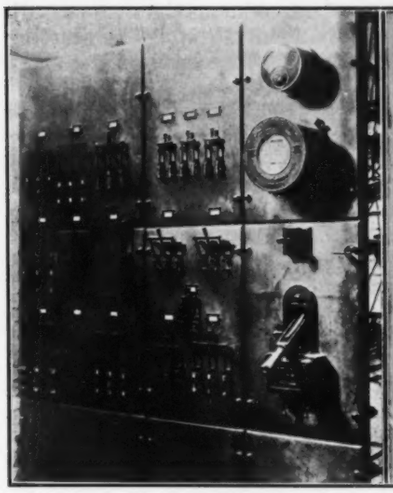
Machinery and methods are governed somewhat by the nature of the raw material. For driving dry pans, sanders, conveyors and bucket elevators, which require constant speed and are non-reversing, the squirrel-cage induction motor appears best adapted to the work. Pug mills, augers, tempering wheels, excavating shovels, etc., require frequent starting and stopping, also excessive starting torque, hence the direct-current compound-wound motor is recommended for this service. For excavating shovels and hoists, the series-wound direct-current motor or the slip-ring type of induction motor should be used.

Among the advantages of electric drive with central station service for clay-product manufacture may be mentioned in particular the overload capacity and uniform speed of the motors. Where individual drive is used the control of any one machine is conveniently at the hand of the operator, the machine can be started and stopped at will, and there is no cost for power after the machine is shut down as would occur were long lines of belting and shafting used. The motors can be placed where convenience dictates—overhead, on the side wall or on the floor—and the machines can be located to best serve the logical sequence of operations. The flexibility of a motor system is also of the greatest advantage, and frequent changes in position of machines and additions to the equipment are often necessary. This condition is easily met when motors are used, as they can be added or shifted with ease by the running of extra feeders.

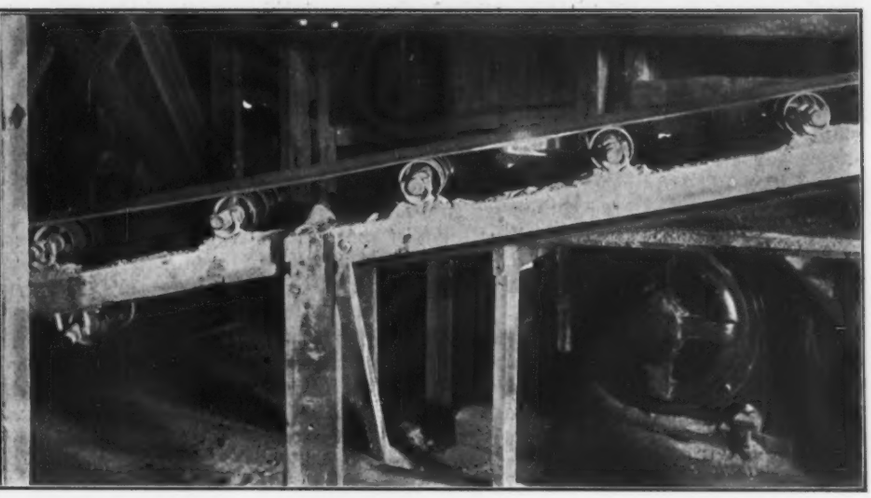
DATA ON POWER REQUIREMENTS

Power requirements of brick plants with a capacity of about 100,000 bricks daily are approximately as follows: Dry pans, 30 hp.; pug mills, 50 hp.; auger machines, 90 hp.; repress machines, 30 hp.

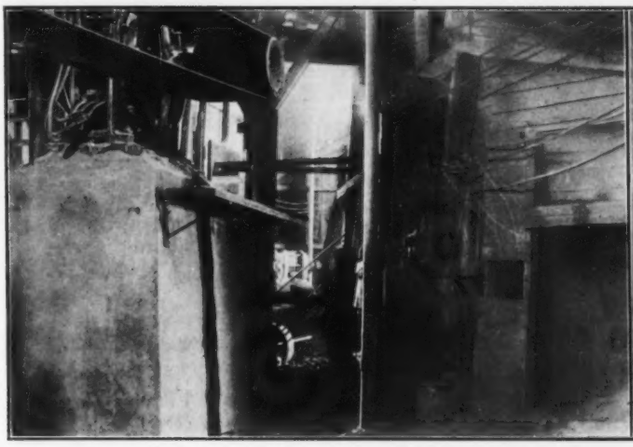
Accurate figures covering the cost of electrical operation of brick plants are difficult to obtain owing to the widely varying factors influencing production. Records from several New England plants with a daily capacity of from 50,000 to 100,000 soft-mud sand-molded bricks indicate a fair average of fifteen to twenty molds of six bricks each per minute or from ninety to 100 bricks per kilowatt-hour for all electric power consumed.



SWITCHBOARD AND INSTRUMENTS FOR BOONE BRICK PLANT



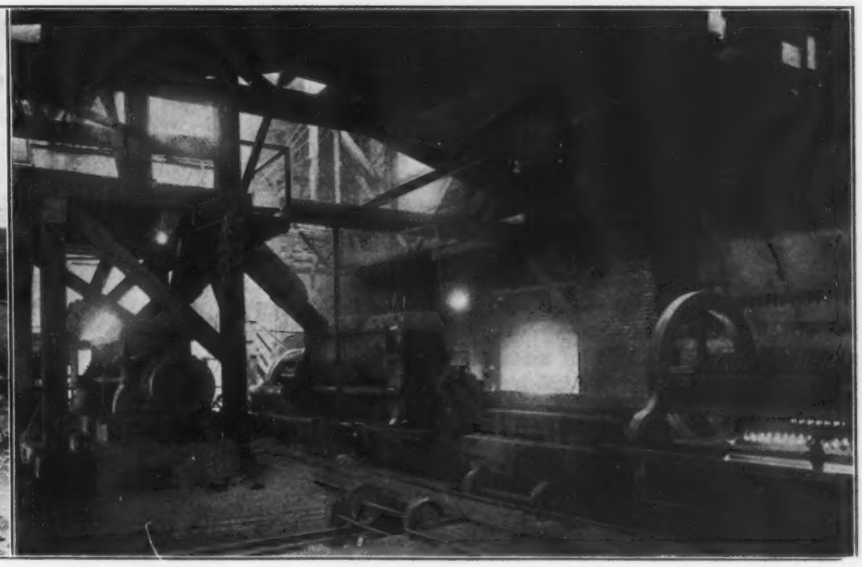
CLAY-SHED CONVEYOR DRIVEN BY 10-HP. MOTOR. AT RIGHT, 25-HP. MOTOR DRIVING 9-FT. FREESE PUG MILL



ON CONCRETE PEDESTAL, 60-HP. MOTOR DRIVING BRICK MACHINES. AT RIGHT, 100-HP. MOTOR DRIVING CRUSHER

INDUCTION FAN (12 FT. BY 5 FT.) DRIVEN BY 12-HP. 1800/900-R.P.M., 220-VOLT MOTOR

TRAMWAY FOR HOISTING MATERIAL



MOTOR-DRIVEN BRICK-MAKING MACHINES IN PLANT AT BOONE, IOWA

Alternating-Current Electric-Motor Drive in the Clay-Products Plant of the Boone Brick, Tile & Paving Company at Boone, Iowa

Plants using the stiff-plastic method show approximately the same output per kilowatt-hour energy expended in brick machines proper. One plant of 156,000 daily capacity shows a power consumption of 1740 kw.-hr. per day for its auger brick machines. Another plant, with a daily capacity of 200,000 common bricks, shows for two successive months an average monthly output of 4,700,000 bricks at an average expenditure of 45,600 kw.-hr. in driving auger machines. Where the change from steam engine or other form of mechanical power has been made an estimated saving in operating expenses of from 20 to 30 per cent has often been effected.

While the total energy required, including auxiliary devices, varies from 12 to 18 kw.-hr., a conservative estimate of power required by pug mills and augers is about 1.5 hp. per 1000 bricks per ten-hour day, or 11 kw.-hr. per 1000 brick produced.

The following data were obtained from tests conducted by the General Electric Company on machines in actual operation. The horsepower required by the several machines mentioned varies widely under different conditions.

Standard 9 ft. dry pan driven at 170 r.p.m. by 35-hp. motor.—During the test a soft dry shale was fed into the dry pan at an average rate of 9.8 cu. yd. per hour. The maximum load recorded was 40 hp.; the average load 29.6 hp. When moderately full of fine dry shale a starting torque of 1450 ft.-lb. was required. If clay is wet as in rainy weather, this value may reach 2000 ft.-lb. and the average load may run as high as 50 hp. When-running empty the dry pan required 12.5 hp.

Special double-shaft pug mill driven at 135 r.p.m. by a 25 hp. motor.—This machine is essentially a long trough in which the pulverized clay from the dry pan is mixed with water by means of revolving paddles. The load varies with the consistency and the quantity of the material handled. The effect of the first factor is small but changes of level in the pug mill due to temporary shut downs of the auger produces great variations in the power required. With mill nearly empty, 6 hp. is needed; with clay up to shaft, 14 hp.; with mill two-thirds full, 25 hp.; when even with top of knives, 35 hp. and when full, an average of 44 hp. When fed at the average rate of 19.5 cu. yd. an hour the average load on the motor was 31.6 hp.; when empty, 5 hp. The starting torque when the mill is two-thirds full is approximately 2300 ft.-lb.

Ten-foot pug mill driven at 248 r.p.m. by 25 hp. motor.—The power required with varying amounts of material in the mill ranged from 5.2 to 25 hp. When fed at the rate of 5.5 cu. yd. per hour the average load was 12.5 hp. With mill full the torque required to start was approximately 300 ft.-lb.

Special giant auger driven at 165 r.p.m. by 125-hp. motor.—This machine is essentially a powerful screw which forces the plastic mass through suitable dies and cuts the issuing clay stream into sections. The load fluctuations are gradual, varying with the quantity and the consistency of the material from 53 hp. with the auger nearly empty to 125 hp. when full. When fed continuously at the rate of 19.5 cu. yd. per hour and the clay level maintained at the top of the blades, the average load was approximately 100 hp. Other test runs show that the power required varies little with changes of speed ranging from 150 to 180 r.p.m. The starting torque required varies with the quantity and consistency of the clay and the period of idleness, but is somewhat more than 2000 ft.-lb.

No. 1 giant auger driven by 35-hp. motor.—This machine when fed at the rate of 5.5 cu. yd. per hour from the pug mill mentioned has an average load of 18.5 hp. The power required varies with the amount of clay in the auger from 12 to 25 hp. The maximum load with hopper full of hard clay is about 35 hp. The starting torque when the mill is filled to the level of the shaft is 750 ft.-lb.

Eagle repress driven at 100 r.p.m.—This machine presses 550 fire brick per minute, the average load being 1.8 hp.

Belt conveyor.—This conveyor consists of a 24-in. belt with a 30-ft. span running at 150 ft. per minute and carrying 19.5 cu. yd. of shale per hour. The average load is approximately 1 hp. and does not vary appreciably with quantity of material moved.

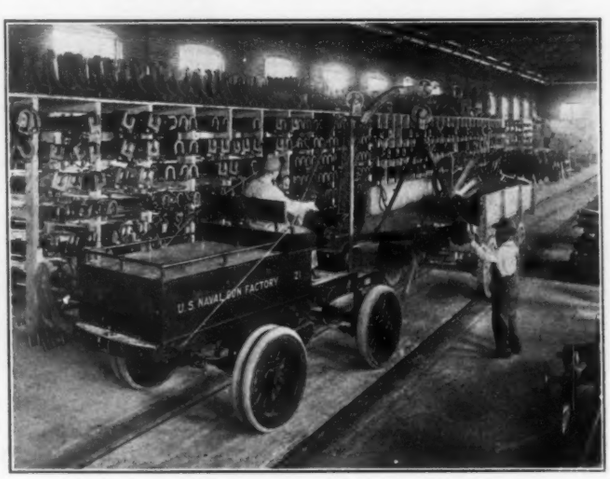
Cup elevator driven by 5-hp. motor.—This elevator consists of a 10-in. belt moving at 470 ft. per minute. When raising material to a height of 36 ft. at the rate of 19.5 cu. yd. per hour, the steady load is 3.6 hp.

Drying drum group driven by 40-hp. motor.—This group consists of a belt conveyor which carries the damp clay from the mixer to a drying drum heated by a blast of hot air forced through it by means of two motor-driven fans. A cup elevator carries the dry clay to the bins above. This group always operates as a unit and requires approximately 40 hp. when normally loaded.

Dry press group.—This group consists of a belt conveyor which brings the dry clay to the pulverizer, where it is ground and emptied into a bin from which it is carried by a cup elevator to the dry press. The conveyor requires about 2 hp. when loaded; the pulverizer takes an average load of about 9 hp. and the cup elevator 3 hp. The dry press running at 130 r.p.m. and pressing 130 brick a minute, carries an average load of 3 hp., making a total average load when the diversity factor is taken into consideration of about 125 hp.

Manifold Uses of Electric Truck in Washington Navy Yard

The industrial truck pictured herewith is employed in the United States naval gun factory at Washington, D. C., for handling parts of naval guns weighing up to 2 tons. The gun carriage about to be handled in the picture weighs 4750 lb. This General Vehicle truck is also used to haul a Troy trailer, transporting loads up to 8 and 10 tons in this way. Shortly after the truck was put in service the large overhead crane in the gun foundry broke down, and just as the officials were about to shut down the shop the battery-driven truck was put into service and handled all the work of the department until the crane was repaired. The truck is also used for shunting freight cars about the yard.



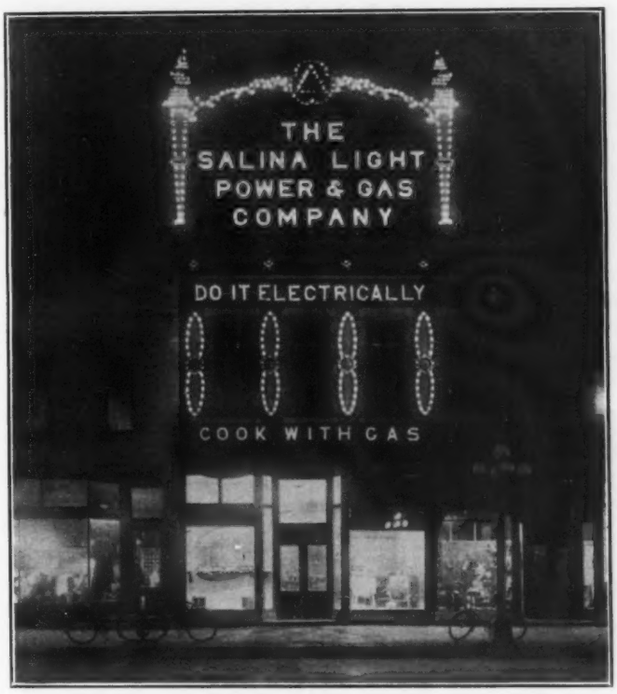
ELECTRIC TRUCK IN U. S. NAVAL GUN FACTORY

MARKETING ELECTRICITY

A Department on Selling Service and Widening the Use of Electrical Energy

Company Display Used to Pledge Merchants to Electric Sign Campaign

Some time before the Salina (Kan.) Light, Power & Gas Company erected the big electric sign and outline display that now marks its building as the brightest spot in town, B. E. Jack, its new-business manager, made a canvass of some of the most prominent business men of Salina and discussed the situation with them. He explained the purpose of the company to erect a large display as the first move in a campaign to make Salina a "sign town," and interested them in the value



THE "BRIGHT SPOT" ON SALINA'S MAIN STREET

of display lighting to the community. Two of these public-spirited merchants agreed to co-operate and led the way by putting signs up on their own prominent buildings as soon as the company's installation was in operation.

Mr. Jack reports: "The very first evening our sign was turned on we had a number of merchants stop in our office or call by telephone to express their hearty appreciation, all saying it was a fine thing for the town. We think this sign has been a very hearty stimulant to the electric sign business at Salina and we are to soon erect a large slogan sign near our Union depot, which we believe will give us a still greater boost.

"The complete display on our building required an outlay of $1,311.40, the cost being made up as follows:

Cost of sign not erected	$940.00
Cost of erecting	86.00
Lamps and transformer	140.00
Color caps	56.00
Flasher and motor	88.00
Inspection	1.00
	$1,311.40

"We charged this amount directly to appliance installations, and expect the net profit on electric signs within the next year to take care of the investment, with the exception of the lamps and transformer.

"We believe that an electric light company has less reason to delay in the purchase of an adequate electric sign for its own use than any other business enterprise. For in addition to the need of electric advertising that applies to any other business, the electric company has the additional reason of setting a good example, in which you could hardly expect other business houses to take the initiative. It was the first thing we did in our campaign, and we thereby showed the merchants of the town what great advantages electric advertising offers both for the individual merchant and for the town in general."

A Map of Prospective Power Customers

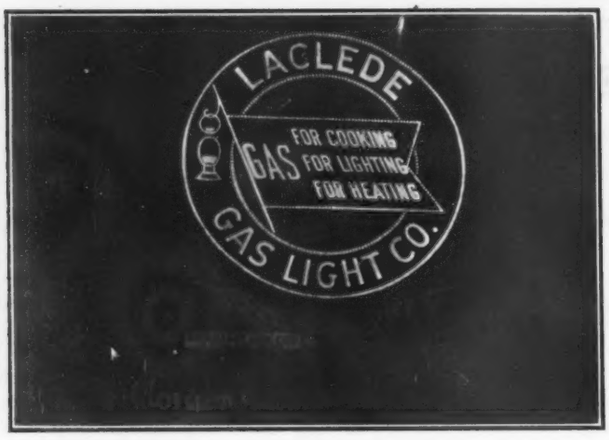
Graphic methods have been used wherever possible, to keep track of prospective motor and industrial customers in the territory of the Ohio Service Company near New Philadelphia, Coshocton and Cambridge, Ohio.

For obtaining power leads, a census has been made of industrial plants not using electricity for driving machines or using it only in part, and this is periodically revised. From this data, district maps are "spotted" to show the location of such plants with the possible loads, to serve as a guide for new-business solicitors. When contracts are closed with any plants so represented, they are stricken off the prospective consumer map. Complete data is kept of the equipment used in each plant so a salesman, before canvassing the prospect, may inform himself on the best methods of drive, operating cost, investment in equipment required, etc.

Engineering reports are frequently prepared to compare the cost of operating with electricity and other powers. Data from plants operating on electricity are filed by industry so power salesmen may use the data in showing prospective consumers what others in the same industry are doing. In the files mentioned is also preserved literature on operating methods in different industries. This serves to acquaint the power salesmen with the requirements of the industries they are endeavoring to electrify.

Signal Blasts for Electric Company's Trucks at Harrisburg, Pa.

By the adoption of a signal system for its motor trucks and delivery cars, the Harrisburg (Pa.) Light & Power Company expects to do much to solve the traffic congestion problems of the city's streets. The company has issued instructions to its drivers to sound a series of blast signals on their automobile horns when approaching cross streets. One blast means "going straight ahead"; two blasts, "going to the right" and three blasts "going to the left." If the signals are observed it is expected that drivers of cars on the cross streets will understand how to turn to avoid collision. The plan has been indorsed by the Mayor and chief of police.



THE ELECTRIC SIGN OF THE ST. LOUIS GAS COMPANY

St. Louis Gas Company Is Large User of Electrical Advertising

One of the latest additions to the large number of handsome electrical display advertisements in St. Louis is the double-faced trade-mark sign of the Laclede Gas Light Company. This sign, which is installed on the roof of a five-story down-town building, is 70 ft. high and 50 ft. wide and carries approximately 3500 tungsten lamps of 10-watt and 24-watt sizes. An equal number of lamps are to be added to the sign at a later date when changeable letter panels are installed beneath the circular trade-marks.

Both sides of the sign are flashed simultaneously by Betts & Betts flashers, and the sign feeder circuit is controlled by a Campbell time switch operating a General Electric contactor. The sign was erected and is maintained by the Brilliant Sign Company of St. Louis.

The Field for an Electric Tractor on the Farm

An exhaustive study of the field for small-size tractors in farm service in the United States has recently been made by J. W. Swaren of Hayward, Cal., in the course of which statistics were compiled on many phases of the subject. The following conclusions were extracted from his report:

The plowing and cultivating of the soil in the United States requires an expenditure of 12,000,000,000 hp.-hr. per annum, which energy is now being supplied by about 20,000,000 animals maintained expressly for this work. These animals work, on an average, 100 days per year, but as they require food whether working or not, the food consumption has to be figured on the basis of 365 days per year. In other words, if the food consumed by the horses were turned into food fit for human consumption, it would be sufficient to feed a population equal to the present population of the country.

After an exhaustive review of conditions, Mr. Swaren reaches the conclusion that steam and internal-combustion engines cannot be expected to replace the horse on the average small farm, because it has not been feasible to build a tractor of either type small enough to be within the price limitations and to do economically the work of a two-horse team. The extremely heavy overloads, the flexibility of control, the light weight and simplicity that would be required to meet these conditions, he states, eliminate all but electric power.

In considering the type of electric tractor that would be best suited to this service, Mr. Swaren points out that the high first cost of a suitable storage battery eliminates that type for the present. His recommendation is in favor of a self-cable-laying and retrieving tractor equipped with two 1½-hp. motors, designs for which were prepared, in a preliminary way, to accompany his report. The designs show a tractor using two seven-ply, 10-in. rubber endless belts as a track, each passing around a 28-in. drive wheel, which in turn is directly connected by worm gear to one of the driving motors.

The purpose toward which Mr. Swaren worked in preparing the designs for this tractor was that it should be a successful substitute for a two-horse team in farm work, the essential elements of the requirements being a size developing 2 hp. with extraordinarily large overload capacity, radius of action of at least ¼ mile, smooth speed range from 1 mile to 2¼ miles per hour, flexible and accurate control, light weight, an operating cost of less than $350 per year, a useful life of fifteen years, a selling price of less than $500, and finally a design that is simple, rugged and easily repaired.

Advertising the Electric Range in Salt Lake City

A full-page newspaper advertisement which appeared on a recent Sunday in the Salt Lake City newspapers, reproduced photograph of ten apartment houses of that city where electric ranges are used exclusively in all the kitchens. This display was published preliminary to a cooking demonstration featured by the Salt Lake *Telegram*, in which only electric ranges were used.

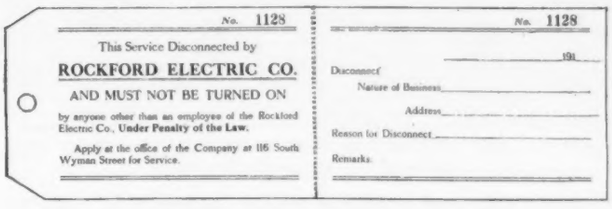
The large number of apartment-house range installations in Salt Lake City and the many private homes where the electric range is now in use, have brought electric cooking into great prominence, and the exclusive use of electric equipment in the cooking demonstration gives evidence of how generally it has been accepted by the public as the modern method.

COOL, COMFORT-
ABLE KITCHENS!
Electric ranges in every one!
Some of the many apartment houses in Salt Lake where kitchens are equipped exclusively with ELECTRIC ranges
Utah Power & Light Co.
Efficient Public Service

A FULL-PAGE NEWSPAPER ADVERTISEMENT, SHOWING SOME OF THE SALT LAKE CITY APARTMENT BUILDINGS WHICH ARE EQUIPPED WITH ELECTRIC RANGES

List of Vacant Wired Houses Furnished Real Estate Dealers

Certain central station companies have found it profitable to advertise for rent vacant houses which are wired for electricity. The Rockford (Ill.) Electric Company, however, is accomplishing the same end without an actual expenditure for advertising these houses. One


No. 1128
This Service Disconnected by
ROCKFORD ELECTRIC CO.
AND MUST NOT BE TURNED ON
by anyone other than an employee of the Rockford Electric Co., Under Penalty of the Law.
Apply at the office of the Company at 116 South Wyman Street for Service.
No. 1128
Disconnect
Nature of Business
Address
Reason for Disconnect
Remarks

TAG ATTACHMENT TO FIXTURE IN VACANT DWELLING

of its commercial department employees takes the half of the disconnect card turned in by the line department, goes out to the premises and on the back of this card writes a brief description of the house. Then at the end of each month a list of all these vacant dwellings is furnished to all the real estate dealers, and among the descriptive items mentioned is the fact that the house is electrically lighted throughout. Meanwhile, if a house is rented the other half of the disconnect card comes through the office and that house is crossed off the list. Thus the list of vacant houses is kept revised from day to day.

Floodlighting Local Monuments—A Fourth-of-July Feature at Allentown, Pa.

Following the announcement of the plan to illuminate the Statue of Liberty in New York Harbor, a wave of interest in the flood-lighting of local statues and monuments has spread over the country. A number of such installations are already under way, as has been noted from time to time in these columns.

At Allentown, Pa.,the Lehigh Valley Light & Power Company recently set up six 500-watt flood lamps to light the local soldiers' monument as a sample of the effect that could be produced by flood-lighting. This trial installation proved to be so satisfactory that the city authorities have now ordered four bronze standards for the base of the statue—one for each corner—at a cost of about $2,000. According to A. H. S. Cantlin, vice-president and manager of the Allentown Electric Company, these standards, which will carry the permanent lamps and reflectors, are expected to be in place in time for the Independence Day celebration at Allentown on July 4.

Fair Booth a Profitable Inquiry Producer

The purchases of a single visitor at the recent State Fair booth of the Merchants' Heat & Light Company at Indianapolis, Ind., amounted to more than the total cost of equipping and maintaining the company's display at the fair. This visitor, a woman, bought an electric range, a vacuum cleaner, and several other appliances. Other inquiries coming to the company's office as the direct result of the display and its attendant newspaper publicity resulted in the sale of several more ranges and some smaller appliances. Judging only from the sales directly traceable to the State Fair display, R. A. MacGregor, sales manager for the company, declared the booth had been a profitable advertisement.

The "Movie" Theater as a Central Station Customer

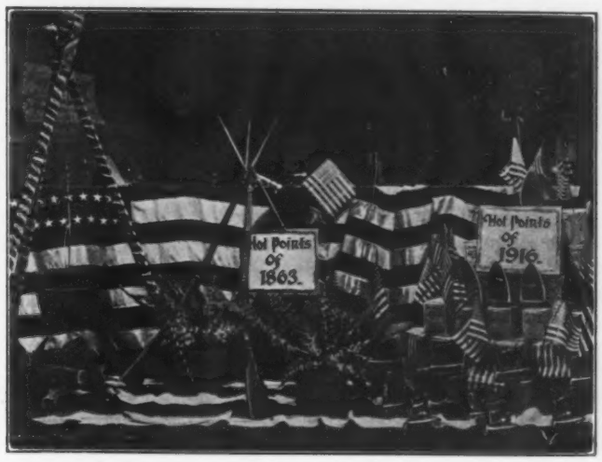
Data recently filed with the Massachusetts Gas & Electric Light Commission by the Edison Electric Illuminating Company of Boston are of interest from the standpoint of energy consumption by moving picture theaters. Ninety-three establishments of this kind are on the company's system. Thirty-one use between 500 and 1000 kw.-hr. per month; twenty-three consume between 100 and 500 kw.-hr.; eighteen between 1000 and 2000 kw.-hr.; thirteen use between 2000 and 10,000 kw.-hr.; one consumes between 10,000 and 15,000 kw.-hr.; one between 15,000 and 20,000 kw.-hr.; four less than 100 kw.-hr. and two from 40,000 to 50,000 kw.-hr. With the exception of one large establishment not listed, the seven largest "movie" houses in Boston consumed energy as follows, in a typical month, the original data having been amplified somewhat:

Theater	Kw.-Hr.	Month's Bill	Connected Load, Kw.	Seating Capacity	Kw.-Hr. per Seat	Avg. Rate per Kw.-Hr., Cents
Park	8,492	$396.58	78.2	978	8.7	4.7
Scollay Sq. Olympia	49,862	1,143.62	262.5	2,580	19.3	2.3
Gordon's Olympia	46,768	1,040.68	244.0	2,032	23.0	2.22
Modern	16,913	623.70	140.7	754	22.5	3.68
Globe	11,460	383.80	101.5	1,655	6.9	3.35
St. James	9,081	360.01	74.8	1,939	4.7	3.98
Fenway	9,386	424.00	72.7	1,523	6.15	4.5

From the above average rates the monthly charge ranges upward to 10 cents per kilowatt-hour in the case of the smallest establishments. In many cases a fan motor installation and sometimes an organ motor are in service, in addition to the house lighting and projector lamps. Roughly, the income from the above larger establishments ranges from $40 to $75 per year per kilowatt of connected load.

An Original Patriotic Window Display at Oak Park, Ill.

Just prior to Decoration Day the Oak Park (Ill.) office of the Public Service Company of Northern Illinois worked up an original and attractive patriotic display which may also be used for July 4. The manner in which it portrayed the "hotpoints" of the days of the Civil War and the modern "Hotpoints" is shown in the picture herewith. The only cost for the preparation of this display, excluding the labor of the office force, was less than $2 for small flags and red, white and blue paper. The old muskets, the kettle and the large flag were borrowed for the occasion.



A PATRIOTIC HOT-WEATHER WINDOW DISPLAY AT OAK PARK, ILL.

Results of Prize Offer for House-Wiring-Month Contracts

To any owner of a house or apartment building signing a contract for wiring during "Wire-Your-Home" Month the Commonwealth Edison Company gave a premium certificate which entitled the recipient to his choice of an electric grill, a pair of boudoir candles, or one of three styles of reading lamps. Cash prizes of $10, $5 and $2.50 were offered to the three contractors in each of the two Chicago associations and to the three salesmen of the Edison company who secured the largest number of contracts.

In the contract department of the Commonwealth Edison Company a chart was posted on the bulletin board during the campaign. This chart was so arranged that arrow heads representing house-wiring salesmen could be moved forward at the end of each week, indicating the record made. This induced not a little rivalry among the company's salesmen.

During the period of the campaign (March 15 to April 15), the total number of house-wiring contracts secured for central station service from all sources was about 700. Of this business, the number secured by the Edison company's salesmen was 443, while the electrical contractors turned in about 150. The company salesmen closed contracts during this campaign at an average rate of about fifteen a day.

Saving the Customer Steps

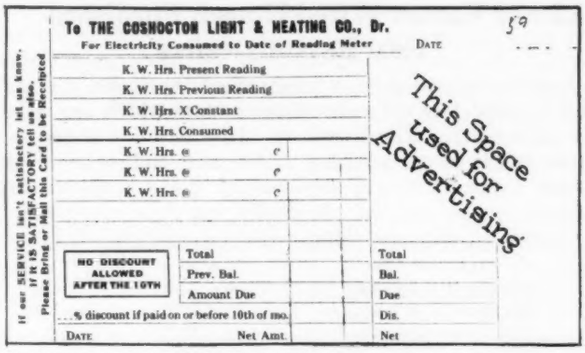
To save customers needless climbing of a stairway leading to the executive offices of the Cumberland County Power & Light Company, at Portland, Me.,

SIGNS THAT SAVE STEPS FOR THE CUSTOMER

when their business is with the contract department or the cashier, the risers of the stairs have been painted as illustrated. This simple but effective method has proved a great convenience to the public, as the sale of appliances, receiving of money, etc., is handled in a street railway waiting room on the ground floor.

Advertising on a Post-Card Bill

Many central-station sales managers believe in the effectiveness of advertising on the face of customers' bills, but those companies which use post-card bills generally find that the card face is fully taken by the billing data. In spite of the small space available on its own cards, however, the Coshocton (Ohio) Light & Heating Company has found it possible to arrange the bill so that a small space is available for a message to the customer. Sometimes special appliance sales offers are made in this space; on other occasions customers are asked to telephone the company when an arc lamp is discovered out


To THE COSHOCTON LIGHT & HEATING CO., Dr.
For Electricity Consumed to Date of Reading Meter
DATE
K. W. Hrs. Present Reading
K. W. Hrs. Previous Reading
K. W. Hrs. X Constant
K. W. Hrs. Consumed
K. W. Hrs. @ ¢
K. W. Hrs. @ ¢
K. W. Hrs. @ ¢
If our SERVICE isn't satisfactory let us know. If it IS Say so on the Card. Please Bring or Mail this Card to be Receipted
NO DISCOUNT ALLOWED AFTER THE 10TH
Total
Prev. Bal.
Amount Due
...% discount if paid on or before 10th of mo.
DATE
Net Amt.
Total
Bal.
Due
Dis.
Net
This Space used for Advertising

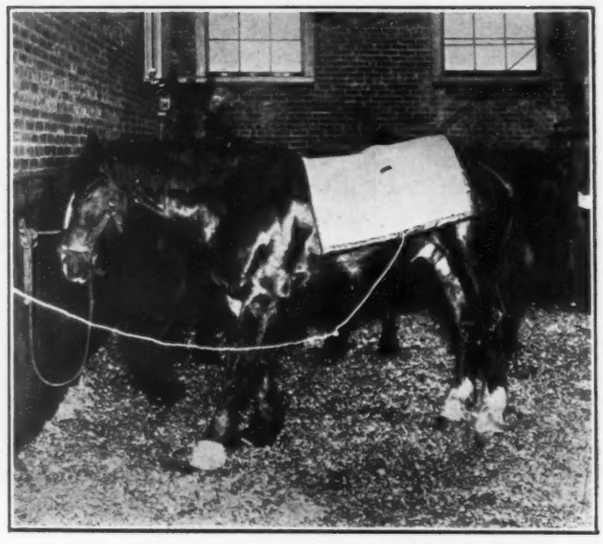
COMPACT ARRANGEMENT OF POST CARD BILL TO PERMIT THE INSERTION OF ADVERTISING

of operation, and at other times the space is used to convey some message about the company's service. In any case something different is printed there each month.

For the fall and early winter months the address sides of the cards bore the following legend: "Regarding Your Bills.—Every care is taken to see that your bill for electric service is absolutely correct. Your meter is thoroughly tested and carefully read. The days are getting shorter and your bills will naturally increase. But if you believe there is any error, that the increase is out of proportion to the increased use of light, let us know. We want every customer of electric service to receive perfect service and be thoroughly satisfied."

Electric Comfort for the Horse

Increased comfort for the sick horse is obtained at the Angell Memorial Hospital for Animals at Boston, Mass., by the use of a specially designed heating pad furnished by the Simplex Electric Heating Company of Cambridge. The pad, illustrated in service herewith, is 4 ft. long and 3 ft. wide; it has three heats and a maximum energy consumption of 600 watts. One side is rubber-covered, and it is connected to any convenient receptacle about the premises by a 25-ft. flexible cord. Dr. F. H. Rowley, president of the Massachusetts Society for the Prevention of Cruelty to Animals, first used the pad in cases of "black water," a disease horses are subject to when overfed and under-exercised. In the first application the pad was substituted for the old-time hot (?) cloths, which continually had to be replaced about the abdominal regions.



ELECTRIC HEATING PAD USED BY VETERINARY SURGEON

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Reducing Size of Service Wires from No. 6 to No. 8 Saves $6,000 per Year for Western Company

A central station company in the Middle West has decided to use No. 8 hard-drawn copper for all customers' service wires, unless a particular load demands wire of a larger size. It is estimated that this practice will save $6,000 during the coming year, if the company continues to grow at its previous rate of 1300 customers a year.

Formerly it was this company's practice to install No. 6 wire almost exclusively for services, No. 8 being used in special cases. In casting about for a means to cut construction costs on account of the present high price of copper, it was observed that no serious trouble from "voltage" drop has resulted from the use of No. 8 wire. On this basis it was decided that No. 8 wire can be used successfully on all customers' services where the limiting factor is mechanical strength.

Safe Construction When Installing Pole Transformers

BY R. E. THOMPSON

Electrical Superintendent Fort Smith (Ark.) Light & Traction Company

Safe construction is demanded in overhead transmission and distribution lines not only from the desire to furnish an uninterrupted service and to prevent damage to the equipment, but also to prevent some unusual mechanical strain or the failure of some piece of material, thus creating a condition which is dangerous either to the public or the workmen on the job. It is not enough that all wires on a pole shall have a proper clearance from other lines when they are put up. If these are so arranged that the breaking of a wood pin or the failure of a tie wire will allow a short-circuit, or permit a high-voltage wire to pull down across a 110-volt lighting line, then such construction cannot be called safe, even though it is all of new material.

The writer has observed a common practice among small plants of hanging distribution transformers below the secondary lines, and bringing the primary taps down to the transformer, even though secondary and service wires pull off in all directions around it. This is certainly a dangerous condition unless the secondary system be permanently grounded, and even then it would be if the ground were defective in any way, for the breaking of a pin, the failure of a tie wire, the working loose of a bracket on the house, or any one of several conditions would undoubtedly bring the primary and secondary lines together with the resulting high potential charge in all connected houses. The logical place for the transformer under such conditions is on the top cross-arm, where any condition short of the breaking of the arm or the falling of the transformer would not permit these lines to come together.

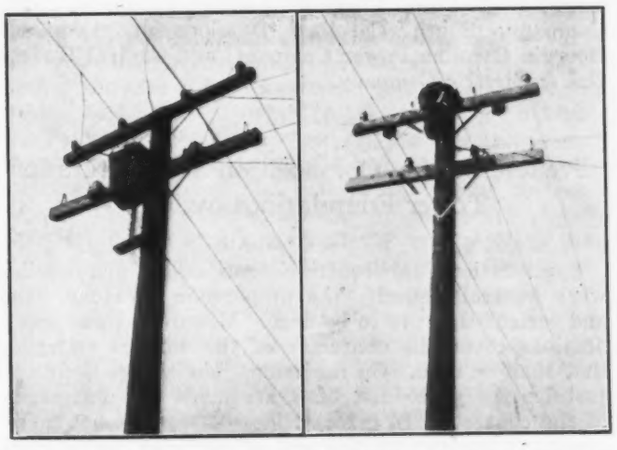


FIG. 1—TWO METHODS OF MOUNTING TRANSFORMERS—THE ONE AT RIGHT IS RECOMMENDED

FIG. 2—A POLE-TOP GIN FOR RAISING SMALL TRANSFORMERS

The main and generally the only objection raised to this manner of hanging is that with a 10, 5, or even a 3-kw. transformer, it is difficult for one or even two men to get the transformer into its position. To overcome this the writer has built the simple pole-top gin shown in Fig. 2, which weighs but 25 lb. and readily enables a lineman to put up a 10-kw. transformer with only the aid of one man on the ground to pull on the fall line of a tackle block.

How an Apparent Overload Motor Trouble Was Traced to Fuse Block

BY R. L. HEARVEY

At a plating plant trouble developed recently with a 5-hp. single-phase General Electric type K. S. induction motor that showed up by the blowing of fuses for several days and then by refusal to start. The motor had been in daily use for six years and the repairman, after examining the equipment, said that new bearings were needed as the rotor was rubbing the stator laminations. The shaft was also cut and grooved, which required it to be turned down so that the bearings could be properly fitted. After the motor had been replaced and in service for a few days the fuses started blowing again.

The repairman found one of the bearings hot, which was taken out and "eased up" a little. A few days later another shut-down occurred. This time the repairman reported that the motor was overloaded, and a larger motor was required. As the plant was being operated exactly as it had been for three years without a shut-down, the owner of the motor would not accept the re-

port, and asked that a thorough examination be made to locate the trouble.

When putting in new reinforced fuses it was noticed that the fuse clips and block had been quite hot, for they were discolored and loose. The clips were closed up until they held the fuse tightly. A close examination of the motor and starter showed them to be in first-class condition. An ammeter was connected in the line and the motor started with no load. The current taken indicated that the winding was not defective. The load of two buffing wheels was then put on and the needle of the 50-amp. meter went off the scale. A further examination of the fuse block showed two loose connections. It was the heat generated by this high contact resistance that was causing the trouble with the fuses. It is very probable that while the rotor was rubbing the stator the motor was taking an excessive current and injured the fuse block.

Construction of Switchboard Cable Trenches

BY M. M. SAMUELS

The grouping and ending of conduits back of a switchboard is often the cause of worry and trouble to the installing engineer. As a rule, the work has to be done just before the floor finish is laid and consequently it must be done in a great hurry. Large sized conduits must be laid at a considerable depth below the level of the switchboard floor in order to be able to bring them up in elbows of a sufficiently large radius for pulling in cables. In hydroelectric plants, this means the lowering of all hydraulic apparatus, and thus increasing the cost of excavation and concrete work.

When conduits come to one panel from different directions the grouping is most difficult, and no matter how much juggling and crossing of conduit is done in the floor, it is almost impossible to bring all the conduits up opposite their respective terminals. Cables have to be looped and crossed and a neat job is almost out of the question. Even if a comparatively neat arrangement is finally arrived at after considerable trouble and perhaps much overtime with double pay, this neatness will not be permanent. Operators seem to like to exchange circuits and cross cables on the back of a switchboard.

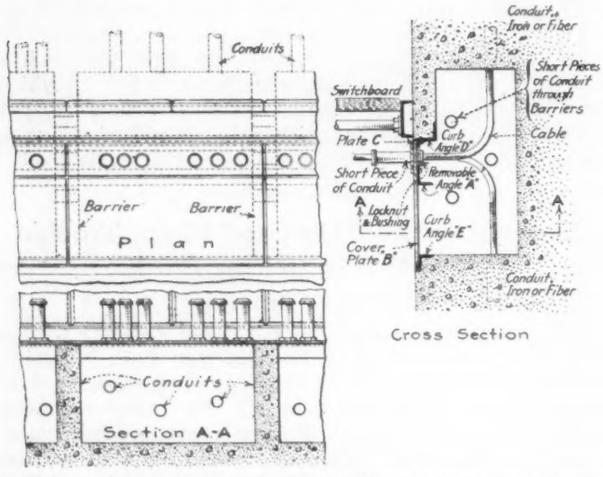


FIG. 1—CONSTRUCTION OF TRENCH BACK OF SWITCHBOARD FOR BRINGING UP CABLES

It has therefore been found of great advantage in the construction of some recent power houses to install a pit under the switchboard such as is shown in Fig. 1. The conduits can be run into this pit from any direction and at any angle. No bends have to be brought up through the floor finish and the conduits therefore can be laid high up near the floor finish. A continuous cover plate along the switchboard containing small lengths of conduits serves to bring the cables up to their terminals. These short pieces of conduits can be arranged in uniform spacings, uniform heights and even uniform sizes. All crossing, looping and offsetting of cables is done in the pit, and the wiring on the back of the switchboard can be made straight and neat.

Barriers should be installed in the pit at suitable intervals. They serve to support the cover plates as well as to separate the cables in suitable groups. Short pieces of conduits can be installed through these barriers to facilitate interchanging of circuits after the installation is completed. In sections containing large cables the angle-iron A in Fig. 1 can be made removable, thus increasing the pulling space.

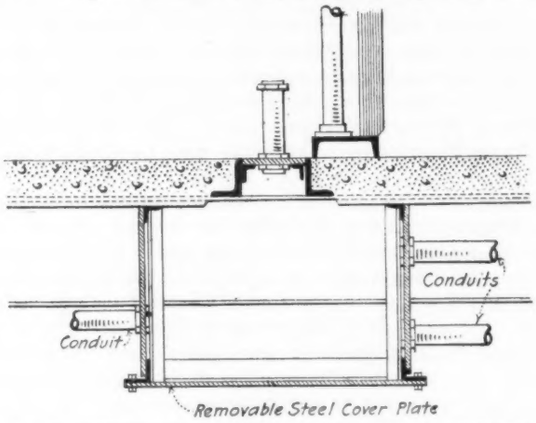


FIG. 2—CONSTRUCTION OF STEEL TRENCH WHEN SWITCHBOARD IS INSTALLED ON A GALLERY

When the switchboard is placed on a gallery and the conduits installed on the floor beams below it is customary to provide a slot back of the switchboard and to bring all conduits up through it. Of late insurance inspectors have been vigorously demanding that such slots be closed up. For such cases it may therefore be possible to construct an artificial steel trench such as is shown in Fig. 2. The only important difference between this trench and the one shown in Fig. 1 is that in Fig. 2, the removable cover plate can conveniently be arranged under the floor and the barriers can be installed under floor beams, making the beams serve as part of the barriers. Such trenches will usually satisfy the super-conscientious inspectors and the construction and operating man.

Pits such as shown in Fig. 1 have been installed by the J. G. White Engineering Corporation in several power houses recently constructed, notably for the Bonny Eagle Power Company, Eastern Tennessee Power Company, South Carolina Development Company, Georgia Carolina Power Company, and Central Hudson Gas & Electric Company.

Predetermining Composition of Concrete for Tower Foundations by Trial

BY R. I. ELKIN

Specifications for concrete foundations and similar work generally specify the proportions of stone, sand and cement that are to be used. Moreover, these specifications cover the character of the various materials that shall be used. On important jobs, where their size justifies the procedure, tests are made for uniformity of the concrete. In certain lines of work it not infrequently happens that the size of particles varies quite widely from time to time, so that the relative proportion of cement and sand likewise will vary. One such

example is in building concrete foundations for steel transmission towers, for here the material is often supplied locally, where the size and grade of rock and sand will differ radically from place to place.

Under these circumstances it is often best to leave to the erection or field engineer's judgment the best proportions of material to use. One very simple method that has been used with good results is as follows: Fill a wooden box of convenient size with the rock or stone that is to be used for a specific case. A box having a capacity of 1 cu. ft. suffices, and has the advantage of not being cumbersome. Then fill in level to the top of the box with the sand that it is intended to use until all voids are apparently filled. After this add water so that the mixture sinks, and all voids are really filled. The volume of water poured into the box is a measure of the amount of cement required for the quality of rock and sand employed. It is generally advisable to add to the cement thus indicated an additional 10 per cent.

Cost of Rewinding Burned-Out Transformers vs. Removing Terminal Blocks for Protection

At the recent convention of the N. E. L. A. at Chicago considerable interest was shown in a paper by D. W. Roper of the Commonwealth Edison Company on "Lightning Protection for Transformers on 4000-volt Distributing Circuits." The author stated in his paper that by either entirely removing the terminal blocks in transformers or by submerging them in oil and placing lightning arresters on the same pole as the transformers instead of on adjacent poles, transformer burn-outs had been reduced from 1.2 to 0.25 per cent while the number of blown fuses due to lightning has been reduced from 12 and 15 per cent to 1.2 per cent.

In the discussion on Mr. Roper's paper it developed that his company does not utilize voltage taps on the transformers, the units being permanently connected for one primary pressure and the secondaries being ready for connection in series or multiple. As terminal blocks were not needed therefore all recent distributing transformers are purchased without them, and they are being removed on the older types as fast as it is possible to do so, when they are taken down from the poles to make way for a unit of larger capacity or for other similar reasons. All transformers removed from poles that have terminal blocks or that appear defective are shipped to the company's repair shops. These shops are centrally located, and the transformers are sent to them from the various district storerooms when a sufficient number will make a load for an electric truck.

When the transformers arrive at the shop they are taken out of their cases and stood on angle irons, each winding and core being situated so that the oil will drip into the case. The winding is then tested with high potential of 10,000 volts between the primary on the one hand and secondary and case and core on the other; and the secondary to case and core at 3000 volts for one minute. If the winding stands up under this test double excitation at triple frequency is applied to the secondary coils, which tests the insulation between turns of both primary and secondary, the one by actual applied voltage and the other by induced voltage. Provided the transformer still appears all right in every way it is tested for ratio or cross-current by connecting it in parallel through an ammeter with a standard transformer. If the unit stands all these tests it is repaired —terminal blocks removed or rewound and impregnated as the case may be—and tested again after being placed in its case. It is then shipped back to a storeroom.

Whenever terminal blocks are removed new leads are always put on the transformer. The cost of doing this is, roughly, as follows:

Rating of Transformer, Kilowatts	Cost to Shops
1 - 5	$4.00
7½-15	5.00
20 -50	7.50
60 -75	10.00
100	12.50

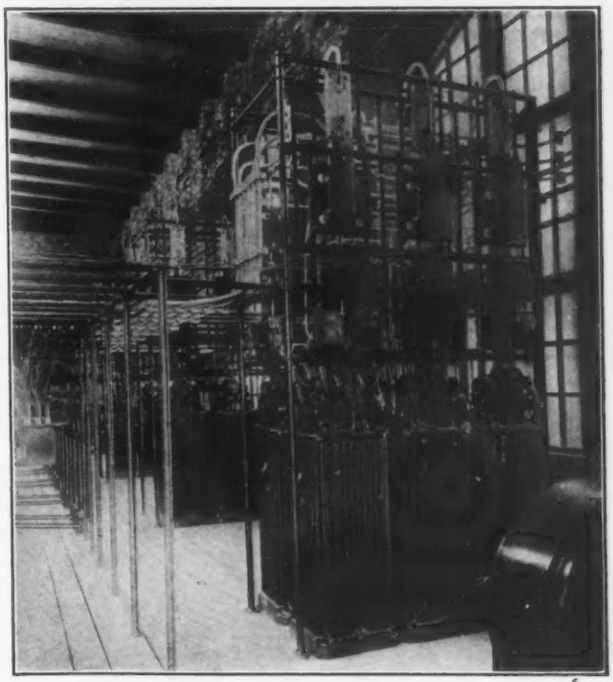
The cost of rewinding the burned-out transformers is a more costly undertaking, but a close approximate cost for the various sizes is as follows:

Rating of Transformer, Kilowatts	Rewinding Cost	Rating of Transformer, Kilowatts	Rewinding Cost
1	$18.00	20	$50.00
2	20.00	25	62.10
2½	20.00	30	76.50
5	23.20	40	95.00
7½	29.40	50	99.90
10	36.20	75	101.00
15	42.20	100	124.50

While these costs are approximate they are suitable for making the estimates for the work by the various departments. They are average costs and are actually higher for transformers of the core type and lower for those of the cruciform type. The cost of transportation and removal from poles is not included in these costs.

Compact Installation of Regulators in a Maine Substation

A recent installation of feeder regulators of the General Electric "IRS" type at the Sewall Street substation of the Cumberland County Power & Light Company, Portland, Me., is of interest on account of its compactness. In this substation several batteries of regulators are in service arranged in groups of six single-phase units, each group occupying a space approximately 6 ft. by 4 ft. by 12 ft., as shown in the accompanying illustration. Each bank cares for two 2300-volt circuits. The banks are mounted on the concrete floor of the switchboard gallery inside a frame made of 1¼-in. pipe. The framing carries above the regulators the usual disconnecting switches, relays, contact-making voltmeters and



GROUP ARRANGEMENT OF REGULATORS SHOWING CONVENIENT AND ECONOMICAL WIRING

resistance coils. The Cumberland company has also provided a horizontal short-circuiting switch of the knife-blade type in each regulator barrier switch group, by which the regulator may be cut out from the substation. Economy of wiring is a feature of the above arrangement.

Methods of Varying Lamp Bank Loads on Two-Wire and Three-Phase Circuits

By Chester H. Keagle

In Fig. 3 of the article by Professor Kammerman in the May 27 issue of the Electrical World, it is evident that by throwing the switch marked 7 up in a position indicated as *A*, it was intended to connect the lamp loads in "delta." According to the drawing, however, when the switch is in this position connections for one set of lamps to each of the switches marked 1 to 6 are not properly indicated, since both ends of a particular set are at the same potential. The intended connection can be secured by reversing the two right-hand leads to the switches 1 to 6 or by reversing the two right-hand connections to the hinges of the double-throw, three-pole switch shown as 7.

Maintaining Uniform Steam Pressures with Fluctuating Steam Demands

The accompanying charts taken at the Hatfield station of the Evansville (Ind.) Railway Company show twenty-four-hour records of steam pressures obtained with hand and automatic regulation of draft. While the contrast is marked, it is not so great as might exist in many plants, since the hand firing was exceptionally well done. The regulator installed in this plant is shown in Fig. 3. A regulator of the same type is used at the steam-generating plant of the Chicago, Lake Shore & South Bend Railway, Michigan City, Ind., but is connected to control both the damper and stoker feed. During the last three years of its use the coal consumption has been reduced 8 to 10 per cent of what it was when hand regulation was employed.

The regulator consists of a counter-weighted lever supported on a knife-edge fulcrum and actuated by a diaphragm on which boiler pressure is exerted. The lever in turn operates a valve which admits water to a hydraulic cylinder or permits it to discharge therefrom, causing a piston to rise or fall and control the damper or stoker feed. Mounted on the same panel with the regulator is a steam gage, a water gage, a low-voltage alarm bell (for signaling the firemen when the furnaces need attention), and a contactor device for operating the latter.

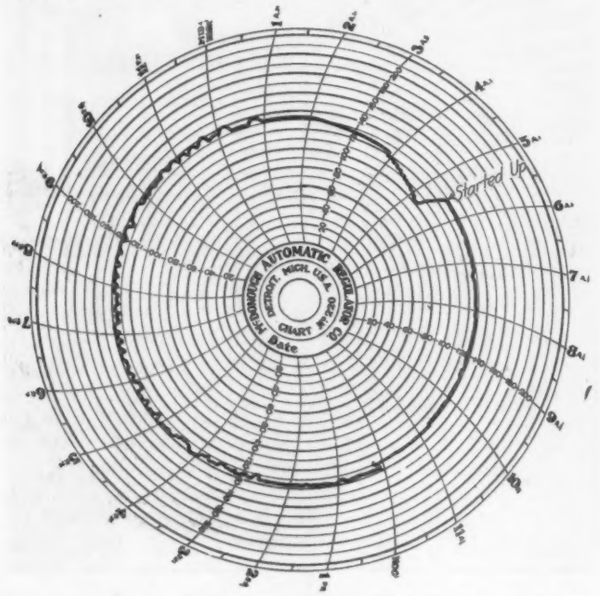


FIG. 1—RECORD OF BOILER PRESSURE OBTAINED WITHOUT AUTOMATIC REGULATOR IN SERVICE

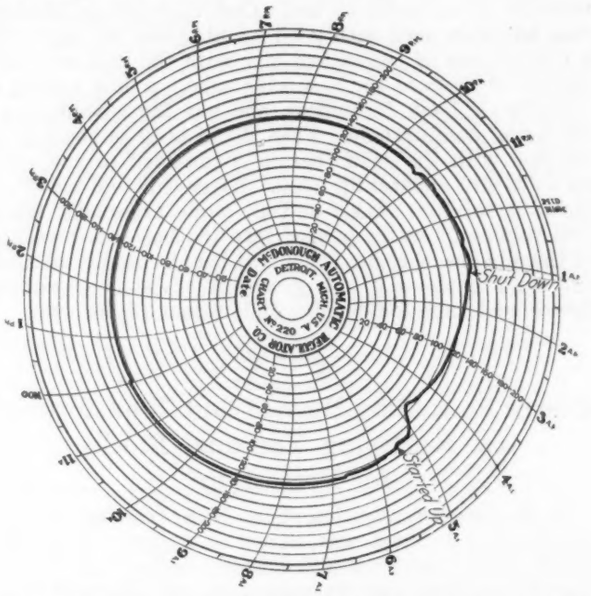


FIG. 2—FLUCTUATIONS IN STEAM PRESSURE SMOOTHED OUT BY AUTOMATIC REGULATOR

While improved performance can be obtained in almost any plant by use of the automatic regulator, its greatest value is shown in plants where the steam demand fluctuates suddenly, since the steam pressure can be maintained within 1 lb. of any desired value. The type of regulator shown is designed to control practically any number of boilers, and is made by the McDonough Automatic Regulator Company of Detroit.

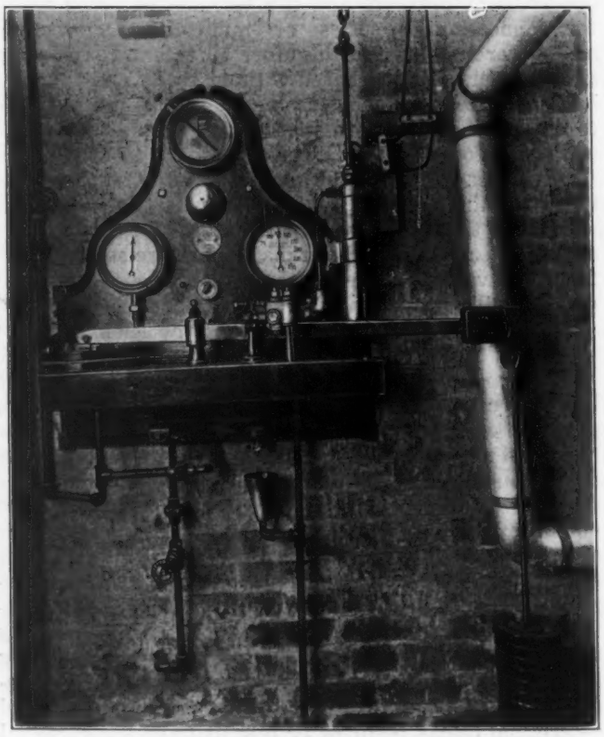


FIG. 3—AUTOMATIC REGULATOR CONTROLLING DAMPERS IN INDIANA GENERATING STATION

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

A Laboratory Electric Arc Furnace

Design of a Tilting Rectangular Arc Furnace of 10 Lb. Capacity, Suitable for the Melting of Metals and the Making of Alloys

WITH the rapid progress of electrochemistry on a large scale, and especially the large increase of electric steel furnaces during the past year, electrochemical research in the laboratory has received a new impetus. A quite elaborate laboratory electric furnace design described by Dr. Oliver P. Watts of the University of Wisconsin in *Metallurgical and Chemical Engineering* of June 15, 1916, is therefore now of particular interest. It is a tilting rectangular arc furnace for experimental work; it has a capacity of 10 lb., and is especially adapted to the melting of metals and the making of alloys.

The furnace body is made of sheet steel ⅛ in. thick and measures 16.5 in. long, 14.5 in. wide and 17.5 in. high in front and back, and 11.5 in. high on the ends. Owing to the severe usage to which the furnace must be subjected, magnesia was the only material considered for the melting pot, which was constructed of magnesia brick 2.25 in. thick. The corners were filled with a cement of electrically fused magnesia moistened with a solution of sodium silicate, so that there might be no places for metal to lodge when the furnace is tilted for pouring. The melting pot is 8.75 in. by 6 in. by 7 in., and has a capacity of 12 lb. metal. By setting the electrodes higher its capacity could be increased to 18 lb. or 20 lb. if desired. For the roof a slab of electrically fused magnesia is used, specially sawed to size, 11 in. by 8 in. by 2.25 in., from a larger solid electrically fused lump.

The high thermal conductivity of magnesia brick and fused magnesia when hot made it necessary to provide special heat insulation. Air-slaked lime is used for this purpose. Two inches of slaked lime were tamped into the furnace, and the melting pot was built upon this. The space between the pot and the steel shell, 2 in. at the ends and 3 in. at front and back, was also filled with slaked lime. In order to pour the metal it was necessary to build a bridge of magnesia from the melting pot to the spout, and to cover this the roof of fused magnesia extended forward within 0.25 in. of the shell of the furnace, making two breaks in the heat insulation. The roof was covered to a depth of 2 in. with slaked lime, and a sheet of asbestos and a wire screen were placed over the top to hold the lime in place when the furnace is tilted. Fig. 1 shows the furnace before the roof was put on, and Fig. 2 is the completed furnace, except that the steel shell was cut away over the spout to a height of 3 in., so that the spout can be used as a charging door. This is closed by a magnesia brick when the furnace is in operation. The total weight of the furnace is 334 lbs., yet it is readily tilted for pouring by one man. Exclusive of refractories, the cost was $50. The linings were put in by students as class exercises.

FIGS. 1 AND 2—LABORATORY ARC FURNACE IN POURING AND OPERATING POSITIONS, SHOWING ELECTRODE HOLDERS, MAGNESIA LINING, AND FURNACE COVER

The electrode holder is shown in Fig. 3. This consists of a casting of red brass, bored for a 1.5-in. electrode. The top of the holder is split, and can be clamped to the electrode by means of two stout screws. Water cooling is essential, and was provided for by drilling holes in the holder and inserting small copper tubes, to which pieces of 0.25-in. rubber tubing are attached. One of these connects the holders with each other; to the others standard hose couplings are permanently fastened for convenience in attaching the 0.5-in. hose, by means of which water is carried to and from the furnace. The electrodes are moved by a screw feed actuated through pinions by a crank beneath the electrode. Since it would often be desirable in melting metals to operate without a slag, the usual

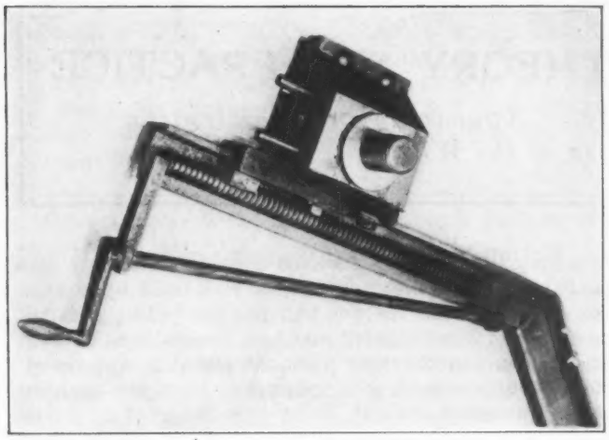


FIG. 3—WATER-COOLED SCREW-FEED ELECTRODE HOLDER

vertical arrangement of the electrodes in steel furnaces was not desirable, and the electrodes were inclined so that they meet at an angle of 90 deg. above the furnace charge. This arrangement has proved satisfactory, although care must be taken not to push one or the other electrode too far into the furnace. A packing of asbestos or similar material is placed around the electrodes when they pass through the roof. The diameter of the electrodes is 1.5 in. Carbon electrodes are used if the power consumption is not more than 20 kw. to 25 kw. For 25 kw. to 30 kw. graphite electrodes are employed.

Although the electrodes have been referred to as passing through the roof, they really emerge from the end walls of the furnace. There are no holes in the slab of fused magnesia, which just fills the space between the electrodes. The end walls are built up around the electrodes to the level of the roof with the cement of fused magnesia and sodium silicate solution previously referred to.

In melting metals it is desirable to heat the furnace before putting in the charge, in order to shorten the time that the metal is subjected to possible contamination by carbon from the electrodes or by oxidation. It is advisable to use a mold that can be lifted to the spout of the furnace, thus avoiding the loss of material and likelihood of freezing, incident to the use of a ladle with such small quantities of metal.

Generators, Motors and Transformers

Determination of the Dimensions of Commutators.—THOMAS CARTER.—A long mathematical article in which the author shows how to develop a simple expression to denote the watts lost in friction and brush contact drop on a commutator. After a short introduction and a discussion of relations between the physical constants concerned an elementary form of the expression is given. This is $R = K \times$ total commutator losses $/[\pi DL\ (S + 2000)\ /2000]$ where R is the temperature rise in degrees Fahrenheit of the revolving surface above the temperature of the surrounding air, due to the total commutator losses dissipated; K is a heating constant (being the rise in degrees Fahrenheit of the revolving surface above the temperature of the surrounding air for 1-watt loss per "equivalent square inch" of revolving surface), D the diameter of the revolving surface in inches, L the axial length of the revolving surface in inches, hence πDL the cylindrical surface of the revolving part, and S the peripheral speed in feet per minute. The author then determines the total losses, which consist of friction losses and contact drop losses, and gives a more developed form of his formula which is applicable to slip-rings as well as to commutators. This is further discussed for commutators only, and two final forms are given which show how the dimensions of a given type of commutator can be determined for a given output from the known characteristics of the brushes used, the permissible rise of temperature, and other specified quantities; and when the commutator dimensions are settled the brush dimensions can be settled also. The effect on the length of a commutator of using various types of brushes is shown both in symbols and in curves, three widely separated classes of brushes being considered and the results are illustrated by numerical examples. The author finally shows how to calculate from simple expressions the weight of copper and the weight of mica in any commutator.—London *Electrician*, May 26, 1916.

Third Harmonics in the Phase Pressure of Three-Phase Alternators with Cylindrical Rotors.—A. E. CLAYTON.—An article illustrated by diagrams in which the author deals with the effect of the angle of spread of the exciting winding and magnetic saturation upon the magnitude of the third harmonics in the phase pressure of three-phase alternators with cylindrical rotors.—London *Electrician*, May 19, 1916.

Traction

British Railway Electrification.—The North Eastern Railway Company was one of the first British companies to introduce electric traction for their Newcastle and Tyneside suburban traffic. This company is now trying electric traction on heavy freight haulage on the Shildon-Newport line, which is used almost exclusively for iron ore and coal traffic. The electrified line has a route length of between 18 and 19 miles, but a considerable portion of the sidings at both ends is also electrified, so that, including the sidings, about 50 miles of single track are equipped for electric working. A high-tension direct-current system is used, current being supplied to the locomotives through overhead contact wires at 1500 volts from two rotary-converter substations. The catenary construction adopted is described and illustrated.—London *Electrician*, May 26, 1916.

Installations, Systems and Appliances

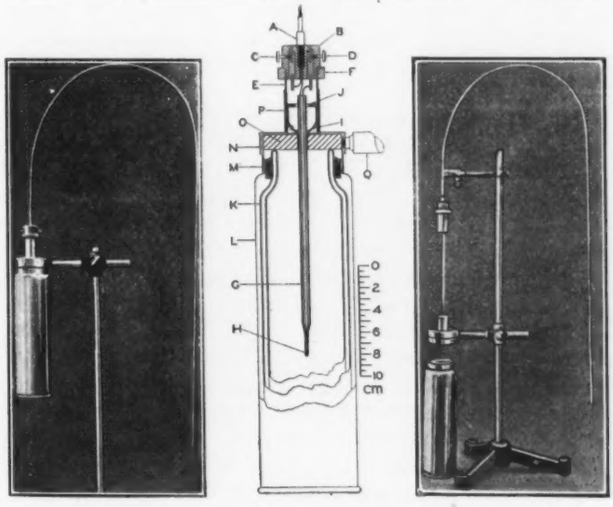
Hire and Maintenance of Direct-Current Motors.—HENRY JOSEPH.—A paper read before the Yorkshire and Western Local Sections of the (British) Institution of Electrical Engineers on hiring out motors by small central stations, with an editorial on the same subject. The author gives the experience of the central station of Hawick. This city has a population of less than 17,000. The total load at the station is only 1280 kw. Nevertheless, owing to the development of motor load the output last year amounted to more than 3,000,000 kw.-hr. There are in the whole district 300 motors, of which 174 (total horsepower 1096) are owned by the consumers, ten motors (451 hp.) are on hire-purchase, and 116 motors (731 hp.) are on hire. Particulars are given of the hire rates, which vary from $2.25 per quarter for a 0.25-hp. motor up to $32.50 for one of 50 hp. The rates have been considerably increased from those of the early days, since the original terms were found to be inadequate. At first quotations were given for the hire of motors after the cost of each installation had been calculated. During the past four or five years it has been found more convenient to adopt a definite rate per horsepower for standard motors. Special motors, such as low-speed or geared ones, are not let on hire unless they happen to be in stock. The hire rate includes the motor complete with pulley, starter, main switch cut-outs, shunt regulator and slide rails, if these are required, all fixed and connected up. The

rental covers the cost of all maintenance and renewals. New brushes are fitted when required, and no question as to whether the company is liable ever arises in the event of a breakdown. Damage occasionally occurs as the result of carelessness or negligence on the part of the hirer's employees, but it has not been considered good policy to raise the question of liability in such cases. They do not often occur, and the inconvenience caused to the user by a breakdown is quite sufficient incentive as a rule for him to urge his employees to treat the motor carefully. Details are given of the financial results which are in general satisfactory, and of the handling of breakdowns and repairs.—London *Electrician*, May 12, 1916.

Electrochemistry and Batteries

Electric Furnace for Iron Ore Reduction.—R. C. GOSROW.—The author discusses the use of coke as a reducing agent in the electric iron smelting furnace. In most plants where the process has been successful, charcoal has been used as reducing agent. In some cases the substitution of coke for charcoal has been tried, but considerable difficulties have been met with. The author discusses how the higher specific gravity and the denser and harder structure of the coke affect the smelting operation in the electric furnace. The author concedes that eventually as the supply of timber becomes exhausted coke or some other form of carbon must be used as reducing agent and discusses the best conditions of furnace operation for the use of coke.—*Met. & Chem. Eng'ing*, June 15, 1916.

Protected Thermo-Elements.—ARTHUR W. GRAY.—A description of the method of mounting thermo-elements developed by the Bureau of Standards to give adequate protection to the wires against damage by contamination or by mechanical strains. The complete thermo-element with its ice bottle is illustrated in Fig. 4 ready for use; the three main parts are separated in Fig. 6; while a vertical section of the ice end is given by Fig. 5. The element represented is of copper and constantan. The silk insulation is left on the copper and the constantan wires except within the glass tube which covers the temperature-determining end. Within this tube the silk is removed from all but a few centimeters at the end farthest from the junction, and is replaced by a glass capillary surrounding one of the wires. As a precaution the silk-covered portions of the wires are treated to a bath of hot paraffin to improve the insulation. The paraffin-treated mahogany head *C* contains the binding posts *C* and *D* for receiving the leads to the potentiometer or galvanometer. The insulating head *B* screws into a short brass tube, *E*, which is provided with a knurled collar, *F*, at the top and is closed at the bottom. Tube G extends down into the middle of the ice bath. The lower end is drawn out thin and contains the thermo-element junction *H*. The copper wires from the ends of the constantan wire are soft-soldered to the extensions of the binding posts, *C* and *D*, as indicated. In order to avoid temperature gradients across these soldered joints, very little solder is used, and, in addition, each wire, covered with its silk insulation right up to the joint, is tightly wrapped several times around the binding-post projection and then embedded in paraffin. Fused around the upper end of the tube *G* is a glass cup, *I*, which holds phosphorous pentoxide covered by glass wool and by the paraffin-soaked fiber washer *J*. The cup *I* is cemented by means of sealing wax into the brass tube *E*. The ice surrounding the junction *H* is contained in a 1-qt. vacuum jar, *K*, which is protected by a thin nickel-plated case, *L*. The ice bottle is suspended from the cap *N* by means of a bayonet joint. Lining the cap *N* is the flat paraffin-soaked cork *O* against which the vacuum jar *K* is pressed upward by a spiral spring in the bottom of the case *L*. The soft copper tube uniting the two ends of the thermo-element is flexible enough to permit bending, and yet is rigid enough to retain whatever shape is given to it. The wires within are thoroughly protected from damage by sharp bending, which is liable to introduce heterogeneity. Vacuum bottles of the type described frequently retain ice in good condition for two days.—*Scient. Papers, Bureau of Standards*, No. 276, May 10, 1916.



FIGS. 4, 5 AND 6—THERMO-ELEMENT PROTECTED BY ICE BOTTLE, VERTICAL SECTION OF SAME, AND ELEMENTS SEPARATED

Units, Measurements and Instruments

Standard Cable Measurements.—B. S. COHEN.—The first part of an illustrated paper read before the (British) Institute of Post-office Electrical Engineers. The first essentials for telephone measurement are standards for the sending, receiving and attenuating of speech. The author mentions the standard transmitters and receivers used by the British Post-office, and states that recently some electro-magnetic transmitter standards have been constructed. These, having less variation than a carbon transmitter, enable a calibration to be carried out in less time. For example, when testing, say, a dozen samples of a new type of transmitter, it is advisable to compare each of those transmitters, *a*, with two carbon standards, *b* and *c*, in order that the triangular test should indicate whether any change in *a*, *b* or *c* has taken place, or takes place during the period of testing. With the electro-magnetic transmitter this can be dispensed with. In one pattern the aluminum diaphragm is 60 mils thick, and carries an armature weighing 4 grams at its center. The natural period of the combination when damped is about 1000 cycles corresponding approximately with the natural period of the solid back transmitter. The field coil is supplied with 300 milli-amp., direct current, through a high impedance coil to prevent transformer action between the field and armature coils. The gap between the armature and pole faces is maintained constant at varying temperatures by supporting the front aluminum ring on iron pillars. The standard of attenuation is a mile standard cable, constants of which are given in the paper. The equipment of a transmission testing desk is described in detail.—London *Electrician*, May 26, 1916.

Moving-Coil Galvanometer.—PAUL E. KLOPSTEG.—A brief mathematical note on the damping factor used in ballistic constants of moving-coil galvanometers.—*Phys. Review*, May, 1916.

Amplitude and Phase of the Higher Harmonics in Oscillograms.—A mathematical article in which the

author discusses the question of damping of a Duddell oscillograph system, and the effect of using different frequencies.—London *Electrician*, May 5, 1916.

Miscellaneous

Tariffs on Electrical Goods.—An article giving brief notes on some tariff regulations for electrical goods in Australia, Sweden, Italy, Guatemala, Russia, Netherlands, Southern Rhodesia, New Zealand and British Solomon Islands.—London *Elec. Review*, April 28, 1916.

Eric Gerard.—An account with portrait of the life and work of the late Eric Gerard, from the pen of H. Hubert.—*La Lumière Elec.*, May 13, 1916.

British Institution of Electrical Engineers.—An account of the annual general meeting held on May 11. The total membership is 6676. The number of members serving or having served in the British navy or army since the beginning of the war is more than 1300; thirty-four have been killed. C. B. Sparks is the president.—London *Electrician*, May 19, 1916.

Book Reviews

Gli Strumenti per Misure Elettriche Industriali (Instruments for Industrial Electrical Measurements). By Ing. Dino Nobili. Milan, Italy: Rivista Tecnica di Elettricita. 502 pages. 220 illustrations.

This is a very useful volume, capable of being used either as a text-book or reference book, on the types, principles and mode of operation of various electrical measuring instruments employed in industrial practice.

The book is divided into twelve chapters, relating respectively to the following subjects: Mathematical formulas and constants, measurements and measuring instruments, resistance, voltage, current strength, power, power factor, energy, angular velocity and frequency, special instruments, protection of instruments in service, tariffs. In addition there are no less than forty-five different numerical tables scattered through the book for the more rapid evaluation of instrumental records. Some of these tables appear to be new.

The treatment is clear, and the text is illustrated with numerous diagrams and pictures of instruments. Vector diagrams are much depended on in the descriptions of alternating-current apparatus. Engineering mathematics, with a good sprinkling of illustrative arithmetic, appears throughout.

The book is a very distinct addition to the literature of electrotechnical measurements.

A Treatise on Electricity. By F. B. Pidduck. New York: G. P. Putnam's Sons. 646 pages. 368 illustrations. Price, $3.60.

This is a mathematical treatise on electricity and magnetism of the Maxwellian type. It is, however, much easier to read than Maxwell's epoch-making treatise. It contains much new matter, presented in a distinctly original way. The presentation is definite, succinct and straight to the point, so that, as an advanced mathematical treatise, it is fairly well adapted to the use of students of electrical engineering, who may desire to improve their theoretical knowledge, and who have had the necessary mathematical training.

The book has fourteen chapters relating respectively to the following subjects: Mathematical introduction; permanent magnetism; electrostatics; electric currents; magnetic effects of currents; thermoelectricity; induced magnetism; induction of currents; applied electricity; electrolysis; electric oscillations; conduction of electricity through gases; radioactivity, and the theory of electrons.

The author is to be congratulated on the production of one of the best text-books on the borderland between electrical engineering and the mathematical-physical theory of electromagnetism which has appeared for a long time. The fact that the units employed are metric and not English, makes the book much easier for electrical engineers to understand, because of the greater simplicity of the equations, rendered possible by the metric system.

Wireless Transmission of Photographs. By Marcus J. Martin. London: The Wireless Press, Ltd. 118 pages. Sixty-two illustrations. Price, 2s. 6d.

This book is intended largely as a guide for experimenters who wish to work on the transmission of pictures by radio. The author, indicating the needs which will be met by a successful system of radio-telephotography and the desirability of working toward that end, helps the inventor by outlining the most important steps in the development to date. A moderate knowledge of radio-telegraphic technology is assumed on the part of the reader, though many of the principles are partially explained in the course of describing the radio-photographic system.

A number of misprints or technical errors occur, such as the reference, on page 29, to a mercury interrupter giving 70,000 breaks per second. There are five chapters, successively on introductory topics, transmitters, receiving apparatus, synchronizing and driving mechanisms, and the telephotograph, which is a system devised by the author. Appendices on the characteristics of selenium and on the production of metal prints for radio-transmission of photographs occupy the last fifteen pages of the book.

The illustrations are nearly all diagrammatic; some additional reproduction of photographs as actually transmitted by radio would be welcomed. The volume appears to be a good summary of certain experiments, and is undoubtedly interesting. The general tone is rather too optimistic, however, inasmuch as commercial long-distance radio-telephotography will scarcely be possible until some time after the greatest problems of radio-telegraphy itself are solved.

Books Received

The Electrical Contractor. By Louis W. Moxey, Jr. New York: McGraw-Hill Book Company, Inc. 86 pages. Fifteen illustrations. Forty-two tables. Price, $1.50.

The Industrial Arts Index. Third Annual Cumulation. Subject Index to a Selected List of Engineering and Trade Periodicals for 1915. Edited by Marion E. Potter, Louis D. Teich and Helen M. Craig. White Plains, N. Y.: The H. W. Wilson Company. 510 pages. Price, $7.

Mechanical Engineers' Handbook. Based on the Hütte and Prepared by a Staff of Specialists. Lionel S. Marks, editor-in-chief. New York: McGraw-Hill Book Company, Inc. 1836 pages. Illustrated. Price, $5.

Cost Accounting—Theory and Practice. By J. Lee Nicholson. New York: The Ronald Press. 342 pages. Seventy forms. Price, $4.

Gas Engine Ignition. Prepared by Earle B. Norris, Robert K. Winning and William C. Weaver. New York: McGraw-Hill Book Company, Inc. 174 pages. 209 illustrations. Price, $1.50.

W. J. SERRILL

Men of the Industry

Changes in Personnel and Position—Biographical Notes

William J. Serrill, the newly-elected president of the Illuminating Engineering Society, has served that body as vice-president and as treasurer, and has been active in the local work of the society's Philadelphia section. Mr. Serrill is engineer of appliances for the United Gas Improvement Company of Philadelphia, with which company he has been associated for more than thirty years, following his graduation from the University of Pennsylvania with the degree of mechanical engineer in 1883.

Charles A. Reynolds has resigned from the chairmanship of the Public Service Commission of the State of Washington. Mr. Reynolds will resume private law practice in Seattle.

Bion J. Arnold of Chicago is receiving the sympathy of his friends upon the death of his mother, Mrs. Joseph Arnold of Hinsdale, Ill. Mrs. Arnold was 75 years old, and is survived by one daughter and seven sons.

Walter C. Fish, general manager of the Lynn Works of the General Electric Company, and Henry I. Harriman, president of the Connecticut River Transmission Company, were elected directors of the Boston (Mass.) Chamber of Commerce at the recent annual meeting.

H. H. Corey has been appointed a member of the Public Service Commission of Oregon to fill the vacancy caused by the resignation of C. B. Aitchison, who has become solicitor for the National Association of Railway Commissioners at Washington. Mr. Corey has been for a number of years the secretary of the Oregon Commission and is well acquainted with its work.

A. D. Fishel has been appointed general sales manager of the Adams & Bagnall Electric Company, Cleveland, Ohio, to succeed Thomas H. Bibber, resigned. Mr. Fishel entered the apprenticeship course of the Westinghouse Electric & Manufacturing Company in 1907, and in 1914 was appointed manager of that company's transformer regulation department. Prior to being made general sales manager of the Adams & Bagnall company he was for three months commercial manager of the same concern.

A. R. Loughborough, who for the past three years has been manager of the Salt Lake office of the Western Electric Company, has been appointed sales manager of the Cincinnati office of the company.

W. L. Davis, who has just been appointed traveling auditor for the American Power & Light Company of New York City, has for the past year been connected with the firm of Ernst & Ernst, certified public accountants of Cincinnati, Ohio. Mr. Davis began his work in the publicity field in 1906 with the Ohio Electric Railway Company, and was appointed statistician of the company in 1909, serving in this work until 1912, when he joined the organization of the Texas Power & Light Company, Dallas, Tex., first as traveling auditor and later as assistant secretary-treasurer. From 1914 to 1915 Mr. Davis was auditor for the Southern Traction Company and the Texas Traction Company, both of Dallas.

Austin C. Dunham, for many years president of the Hartford (Conn.) Electric Light Company, and long a leader in the central station industry, celebrated his eighty-third birthday anniversary on June 10 at his home in Hartford. Until recently Mr. Dunham had supposed he would be 84 years old this year, but reference to the records gave him, as he terms it, a year as a birthday present. He received many tokens of regard and affection to mark the day, including a big basket of roses from the officials of the Hartford Electric Light Company. Mr. Dunham spends his winters in Cuba, where he has a home. He is in excellent health and retains his lively interest in public affairs and questions of the day.

J. C. Donald, who has resigned as electrical engineer and general superintendent of the Asheville Power & Light Company, Asheville, N. C., has been appointed assistant to the vice-president and general manager of the Ironwood & Bessemer Railway & Light Company, with headquarters at Ashland, Wis. Mr. Donald began his electrical career in New England with the Boston Elevated Railways and in the Pittsfield (Mass.) works of the General Electric Company. Later he was appointed electrical engineer and superintendent of the railway and lighting company at Natchez, Miss., resigning to become superintendent of the Citizens Light, Heat & Power Company of Montgomery, Ala. Prior to coming to Asheville, five years ago, Mr. Donald served for two years as superintendent of electrical construction with the Chattanooga (Tenn.) Electric Company and the Chattanooga Railway & Light Company.

L. T. MASON

L. T. Mason, vice-president of the Hornell Electric Company of Hornell, N. Y., celebrated the thirtieth anniversary of his connection with the company and of its organization with a reception, June 1, to the company's customers and friends. The first Hornell electric-lighting company was chartered on April 26, 1886, and beginning operation on June 1, 1886, operated fifty-five arc lamps on an all-night schedule at $105 per lamp per year. A year later an Edison three-wire system was installed for incandescent lighting and power purposes. In 1899 the company also went into the steam-heating field. Mr. Mason was one of the original promoters of the old American Illuminating Company of Hornell and became the first superintendent and secretary of the organization and of its successors, holding these positions until 1913 when he was elected vice-president. Mr. Mason's fellow citizens of Hornell declare that it is largely due to his efforts that the business of the company has reached its present prosperous condition.

T. T. Parker, formerly commercial manager of the Kansas Electric Utilities Company of Parsons, Kan., has been appointed manager of the Union City (Ind.) Electric Company.

J. A. Perkins, who has been appointed general manager of the Lockport (N. Y.) Light, Heat & Power Company, succeeding E. Z. Wallower, was formerly general manager of the Union Gas & Electric Company of Bloomington, Ill.

Obituary

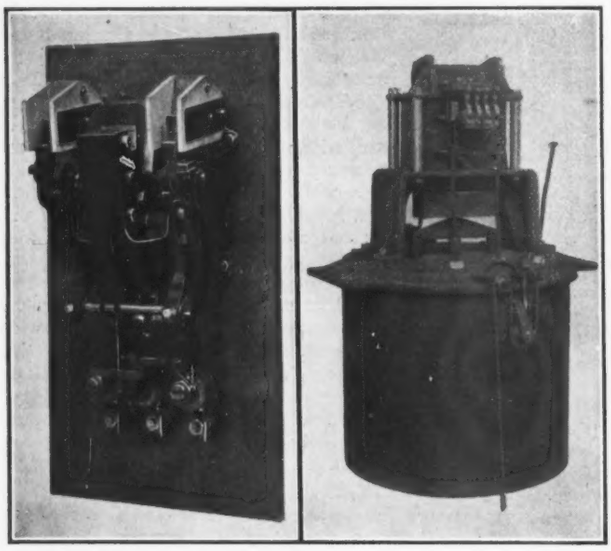
R. W. Ferguson, general manager of the United States Incandescent Lamp Company of St. Louis, Mo., was killed, together with two employees, on June 6, by the explosion of an oxy-acetylene torch outfit while supervising the repair of a tank at the lamp company's factory. An explosion had occurred in the gas house earlier in the morning, and the oxy-acetylene apparatus was being used to repair that damage when the fatal accident occurred. H. G. Ferguson, proprietor of the lamp concern, was standing near his brother when the explosion took place but was only slightly injured.

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Magnetic, Solenoid and Motor Operated Switches for Controller Work

The use of electrically operated switches on control apparatus presents an entirely different problem than the use of switches in central stations and for switchboard work. In the case of the latter switches, commonly called circuit breakers, the operation is not very frequent, and therefore the parts are not greatly subjected to wear. In such a case it is therefore possible to use relatively complicated driving mechanisms with many parts without decreasing the efficiency of the apparatus. On the other hand, switches used for motor-controller work are operated frequently, in some cases as often as once every second, and the wear of the parts during operation becomes an important item. Therefore the number of the parts of these switches has to be reduced to a minimum, and in order to reduce the wear the parts must be relatively heavy. This increases the inertia of the moving members and has a tendency to reduce the speed of operation, while speed of operation is of greatest importance where heavy currents are to be handled. The increased inertia of the parts is another reason for the reduction of the number of such parts.



FIGS. 1 AND 2—CLAPPER-TYPE MAGNETIC SWITCH AND LARGE ALTERNATING-CURRENT SWITCH OPERATED BY DIRECT-CURRENT MAGNETS

Direct-current switches for low voltages have been successfully built for solenoid operation with ratings as high as 10,000 amp. The energy required by direct-current solenoids is relatively small, and in the case of the 10,000-amp. switch, above mentioned, the total consumption is only approximately 100 watts. Furthermore, there is practically no limit to the size in which direct-current magnets can be substantially built, it is claimed, so as to work at sufficient speeds for the operation of switches of large capacity.

In direct-current magnets the only energy which has to be considered is that consumed by the coil of the magnet. In alternating-current magnets, on the other hand, there is not only the current consumption of the coil proper, but also hysteresis and eddy current losses in the iron. These losses are of much greater magnitude than the losses in the coil, and in order to keep them within reasonable limits the iron structure of the magnet has to be laminated. This naturally weakens the magnet structure where very large ratings are required. Also, the larger the magnet the smaller is the radiating surface through which the heat, due to the losses can be dissipated, and therefore, we come very soon to a practical limit beyond which alternating-current magnets cannot be built to operate successfully for very severe service. Furthermore, with alternating-current magnets there is a tendency for the apparatus to be noisy in operation, due to the pulsating pull of the magnet and the relatively heavy armature which has to be employed to maintain a certain amount of pull. A relatively high current is taken when in its open position. It is true that this current is automatically reduced quite materially when the magnet seals, but the apparatus employed for controlling the current in the magnet coil has to take care of the very heavy inrush current, and is therefore subjected to very great wear. For these reasons, therefore, large switches for handling alternating currents have not been built with alternating-current magnet operation. It must be remembered also that alternating currents of large power and high voltage are most effectively handled under oil, and these switches are therefore mostly of the oil-immersed type.

For small currents and low voltages which can be handled in oil satisfactorily, airtight switches of the clapper type have been developed and are in successful use for several years. Fig. 1 shows one of these switches. Small oil-immersed switches for pressures up to 2200 volts and relatively low currents may also be handled by alternating-current magnets, such as are shown in Fig. 3. A switch which is operated with a direct-current magnet taking power from a direct-current source of supply is shown in Fig. 2, having a rating of 500 amp. at 6600 volts.

For those installations where alternating-current switches are employed for controller work with no direct-current

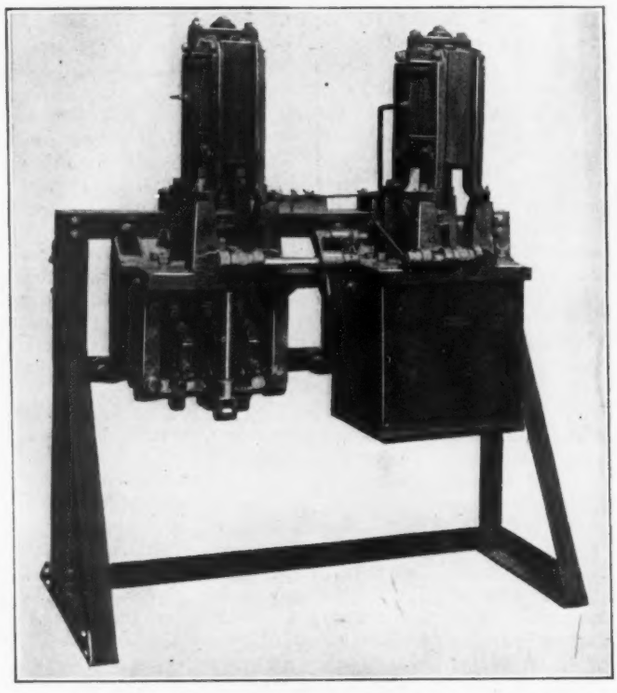


FIG. 3—OIL-IMMERSED SWITCHES OPERATED BY ALTERNATING-CURRENT MAGNETS

source of supply available a motor-operated switch has recently been developed by The Cutler-Hammer Manufacturing Company, Milwaukee, which operates directly or through a stationary transformer from the alternating-current source of supply.

With the motor-operated switch the motor armature is connected by means of a lever and crank to the operating mechanism of the switch and the motor circuit is closed the entire time during which the switch is to be closed, so that the switch operates on "no voltage." To operate the switch directly from the motor armature by means of a crank would require a motor of very large proportions, due to the large torque required. Furthermore, such a motor would consume considerable energy, and in view of the fact that the motor armature stands still the entire time during which the switch is closed, with exception of the short interval required for closing, it would be difficult for the motor to dissipate the energy which is developed in it. The simplest type of motor, however, can be used for such an installation, namely, a squirrel-cage motor.

In order to reduce the size of the motor it is, of course, possible to gear the armature to the operating mechanism in such a manner that the armature makes several revolutions for the closing of the switch. This reduces greatly the size of the motor and obviates the difficulties stated above. There is, however, one difficulty to overcome. The armature, after having made several revolutions, attains quite a momentum, and, when the switch is closed, it has to come to a sudden stop. With no provision against this contingency there would be produced a considerable strain on the motor shaft and the gearing which would lead, after a relatively short time, to destruction of the apparatus. The inertia of the armature must be gradually absorbed outside of the positive stop on the switch without cutting off the power supply from the motor. Similarly, when the motor is cut off the line the armature revolves backward and it is necessary for the operating mechanism to accelerate the entire armature. This consumes considerable time, and when the switch reaches its open position the armature if coupled tightly with the operating mechanism produces another shock on the mechanism and gearing when stopped.

The new Cutler-Hammer switches are designed to obviate these troubles. The armature is connected with the operating mechanism by means of a pinion and gear sector, but instead of being keyed directly on the shaft of the motor the pinion is connected with a slip clutch, which is set for a maximum torque slightly in excess of the torque developed by the motor at standstill. When the motor is first energized the armature is accelerated and in moving it drives the operating mechanism through the slip clutch, closing the switch. When the switch parts reach their ultimate limit the operating mechanism is stopped in a suitable manner, while the motor armature continues to revolve, causing slippage of the clutch, which gradually absorbs the inertia stored up in the armature, until the latter comes to a standstill and keeps the switch closed. When the circuit to the motor is opened the switch members which are under tension accelerate the armature backward and when the maximum opening of the switch is reached the switch members are stopped in a suitable manner and the armature is free to rotate through the slip clutch. The slip clutch therefore prevents over-straining of the operating members of the switch.

The motor is designed so that it develops maximum torque at standstill, resulting, therefore, in the smallest possible motor for the work in question. The motor armature is built as lightly as possible, so as to reduce the inertia effect and permit of rapid acceleration in either direction so as to produce a rapid closure and opening of the switch. The armature shaft is supported on ball bearings which require practically no lubrication or attention, and all other parts are so rugged, the manufacturer claims, that they will stand up under service indefinitely. Particular attention is directed by the maker to the slip clutch, which is built in a substantial manner and provided with an asbestos friction face.

Switches of the type described above may be built in any capacity, and they have already been built for handling, in a three-pole type, currents of 1000 amp. per phase (see Fig. 4). Two such switches may be combined for reversing the primary of the motor circuit which is to be controlled, and in this case they are mechanically interlocked in such a manner that one switch can only close after the other switch is fully opened.

The contact parts of the switches consist of copper-leaf brushes, which are protected by solid-metal-block auxiliaries, and the contacts are arranged so that they separate in a horizontal plane, producing a horizontal arc. This is easily extinguished by the oil, which, being heated by the arc, has a tendency to blow upward, or at right angles to the arc. The quickest possible elongation of the arc is obtained, it is pointed out. The copper-leaf brushes have the advantage that each leaf forms a probable line contact, making it impossible for an oil film to produce a high resistance between the contact plate and the copper-leaf brush. On the other hand, the heavy-metal-block auxiliary contacts have a great cooling effect on the arc, causing it to be rapidly extinguished, and, in order to prevent an oil film from producing a high resistance between the auxiliaries, which might cause sparking of the main brushes, the two contact blocks engaging with each other are slotted diagonally, the slots of the two blocks crossing at right angles so as to permit the pressure exerted on the blocks to remove the oil film as rapidly and efficiently as possible.

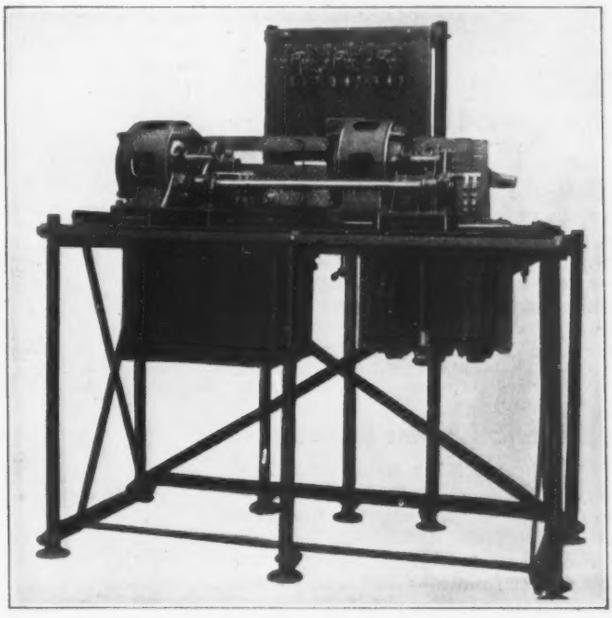


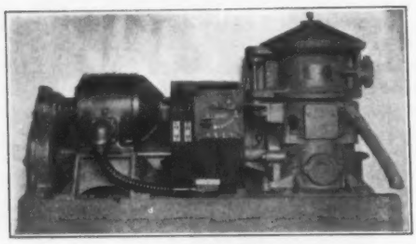
FIG. 4—MOTOR-OPERATED OIL REVERSE SWITCH

The contacts are inclosed in an oil tank which is easily removable and which is supported from the cast-iron structure which also supports the motor and other operating gear.

Motor-Driven Coal Crusher and Sampler

Many public-service corporations, cities, towns and government institutions are buying coal by analysis. As everyone knows who has been engaged in this work, sampling which is done by hand is a long, tedious and frequently an inaccurate undertaking. The Sturtevant Mill Company, Harrison Square, Boston, Mass., has brought out a machine which automatically crushes and samples the coal in one operation, in large or small quantities, and what has heretofore required hours or days to perform by hand methods, therefore, is now reduced to minutes, the manufacturer points out, and any coal miner or user can know just what he is selling or buying. In the accompanying illustration is shown a crusher connected directly to an electric motor. The coal is fed into the hopper in 3-in. pieces or finer, where it is nipped by the top crushing members and then is subject to gradual reduction until discharged at the periphery below. A sample spout is placed opposite the discharge opening and is arranged to remove a certain percentage of the product. The sample thus secured is exactly representative of the whole, in-

cluding the correct proportion of coarse and fine coal and slate, sulphur or other impurities that are fed to the machine. This sample, it is declared, is the direct discharge, being unaffected by scrapers, mixers or other devices. The machine is very simple, massive and compact and is strong enough to crush coal and the various impurities found therein. It operates at a low speed without vibration on any floor and can be instantly adjustable for fine or coarse work while in operation by simply



COAL CRUSHER AND SAMPLER DIRECTLY CONNECTED TO MOTOR

turning the hand wheel. It may be set so as to turn out 0.25-in. pieces or 0.75-in. pieces and deliver a uniform product. "Open door" construction gives complete accessibility for inspection or replacement of parts, or changing sample spouts. The crushing members are of chilled iron.

Electric Lemon Squeezer

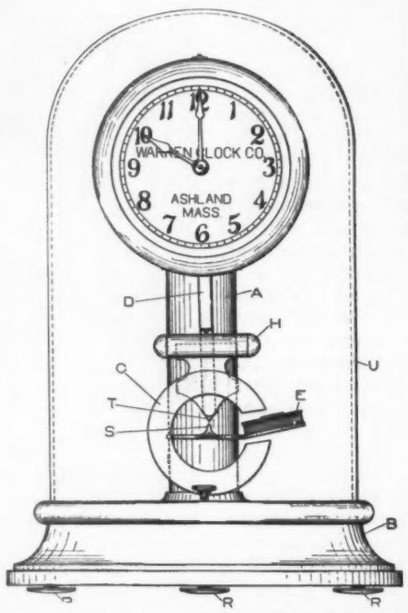
The Thomas Mills & Brothers Company, Philadelphia, Pa., has recently developed the electrically operated fruit juice extractor illustrated herewith. This outfit is suitable for use in restaurants, soda fountains and other places where it is necessary to extract the juice from large numbers of lemons and oranges. It consists of a motor-driven hemisphere provided with ribs similar

MOTOR-DRIVEN LEMON-SQUEEZING MACHINE

to the ordinary hand-operated glass extractor. The lemon or orange is halved and held against this hemispherical part. The juice is caught in a deflector at the back and runs down through a spout at the bottom. A clamp is provided for attaching the outfit to a table or counter and a ring is attached below the spout to support the glass. The outfit is equipped with a 0.10 hp. universal type, 3000-r.p.m. motor made by the Robbins & Myers Company, Springfield, Ohio.

Battery-Operated Clock

An interesting device recently brought out is the clock shown herewith, the pendulum of which is operated electrically. From the base of the clock, *B*, there arises a column, *A*, which forms a support for the pendulum, and the movement, and which contains the battery. The pendulum consists of a permanent magnet, *C*, and a rod. Mounted upon the column, *A*, and within the gap or opening of the magnet, *C*, is a coil of very fine insulated wire, *E*, and the ends of this fine copper wire are firmly soldered to two brass rods at the back



FRONT VIEW OF BATTERY-OPERATED CLOCK

of the column. Within the column is a special battery cell. Mounted upon the pendulum rod is a brass case, *H*, within which is an electric pulsator, which may be called the heart of the clock and which consists of a sealed glass tube from which air has been carefully exhausted. Inside this glass tube in an inner steel tube, protected from all atmospheric influences such as dust, moisture or oxidation, is a device which sends electric impulses through the coil, *E*, at every complete swing of the pendulum. These impulses are of such a nature as to maintain the swing of the pendulum in practically the same width of arc whether the battery is new or old, it is declared. If the swing of the pendulum is increased or decreased by external means, the electric pulsator, *H*, will quickly restore it to its normal value. The reciprocating or swinging motion of the pendulum causes a bracket to move to and fro across the axis of a magnetic needle and forces the latter to revolve once for every complete swing of the pendulum. By this means the oscillating motion of the pendulum is converted into a continuous motion of rotation of the needle, and this needle by means of a screw thread transmits the motion at a greatly reduced rate to the first gear of the clock train. The clock works are protected by a dust-tight cover. The thousand-day magnetic clock, as it is called, has been developed by the Warren Clock Company, Ashland, Mass.

Spot-Lamp Dimmer

The tungsten spot or lens lamp is rapidly replacing the ordinary hand-fed arc lamp as a means for portable stage lighting. To increase the value of this

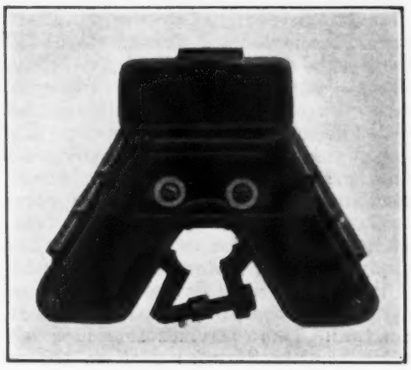
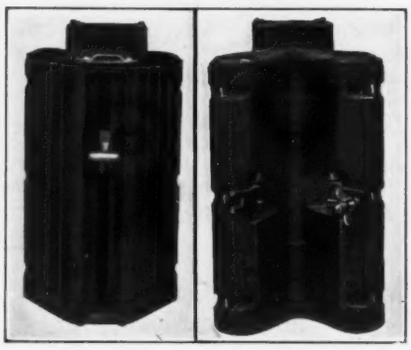


FIG. 1—INCLOSING BOX TO WHICH TERMINAL LEADS ARE CARRIED

lamp for this work, the Ward Leonard Electric Company of Mount Vernon, N. Y., has recently brought out a device called a spot-lamp dimmer. In the accompanying illustrations is shown a dimmer designed for use with 1000-watt tungsten lamps and so constructed that it can be mounted on the upright lamp support. All energy-carrying parts of the device are inclosed. The dimmer is comparatively light in weight, has fifty steps of control and will dim a 1000-watt gas-filled lamp from its full candlepower to blackness. In Fig. 1 is shown the inclosing box to



FIGS. 2 AND 3—FRONT AND BACK VIEWS OF 1000-WATT SPOT-LAMP DIMMER

which the terminal leads are carried. The dimmer or rheostat is mounted upright on the standard as already noted and the handle moves up and down in the slot as shown in Fig. 2.

Inexpensive Types of Electric Ranges

To meet a demand for ranges of the low-priced types, the Hughes Electric Heating Company, Chicago, has brought

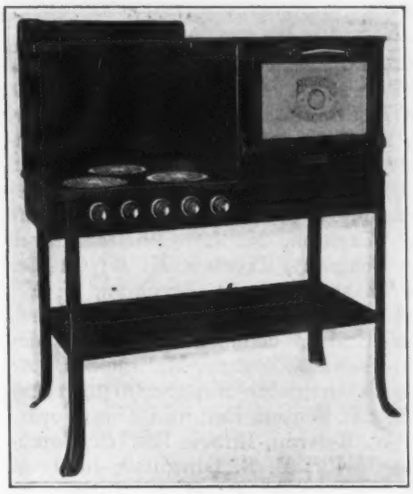


FIG. 1—THREE-BURNER RANGE

out four new models of electric ranges, which are to sell at lower prices than other ranges developed by the company. The new line consists of all-black-enameled ranges which are much lower in cost owing to the omission of fancy nickel-plated legs and trimmings, white-enameled splashers and other costly features. Another reason why these ranges can be priced so much lower is because their legs are not cast but are formed from angle iron.

The lowest-priced range of this new line is the "C 18." This range has a two-unit cooking surface, one unit with maximum rating of 1500 watts, the other of 880 watts. It also has a

FIG. 2—TWO-BURNER ELECTRIC RANGE

two-unit, 18-in. by 12-in. by 12-in. oven, each unit having a maximum rating of 880 watts.

The highest-priced stove of this group is the "C 4" which is of the cabinet type. It has a three-unit cooking surface, two-unit, 18-in. by 18-in. by 12-in. oven, outside elevated warming shelf and outside lower shelf. The maximum ratings of the cooking units are 1500 watts, 1100 watts and 880 watts. The oven units take 1100 watts each. The two other types vary in design and capacity between the small "C 18" and the larger "C 4" range.

To give some idea of the popularity of this inexpensive all-black-enamel line, it may be said that forty-two of the "C 4" type were sold recently for installation in the new Imperial Arms Apartments in Portland, Ore.

Two-Stroke-Cycle Fuel-Oil Engine Without Compression in Crankcase

The Chicago (Ill.) Pneumatic Tool Company is building fuel oil engines which it claims are particularly adapted to the needs of small generating plants. These engines are of the horizontal, straight-line type, guaranteed to run on any mineral oil of 28 deg. Baumé scale or lighter, and containing not more than 1 per cent sulphur. Differing from most two-stroke-cycle engines, the compression in the crankcase has been eliminated by the provision of a closed chamber at the crank end of the cylinder. This makes possible a crankcase which is very accessible, and also allows the use of the splash system of lubrication.

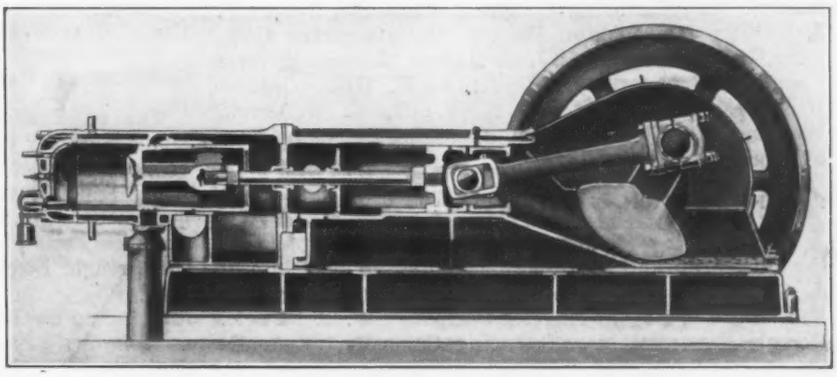


FIG. 2—SECTIONAL VIEW OF FUEL OIL ENGINE

Another feature in the mechanical design of the engine is the use of a crosshead, which is claimed to reduce to a considerable extent the wear on the cylinder walls, since the side thrust is entirely eliminated. With this construction, the piston is not required to act as a guide or to take up any heavy side thrusts and may, therefore, be constructed with much less metal in it than is necessary without the crossheads. The piston in this engine weighs only about 80 lb.; the elimination, therefore, of heavy reciprocating parts contributes materially to the smooth running of the engine.

The operation of the engine has the simplicity which is characteristic of all two-stroke-cycle units. As the piston reaches the end of the power stroke it opens a port on each side of the cylinder, one of which admits the pure air compressed in the crank end of the cylinder by the left stroke of the piston, helping to force the burned gases out through the exhaust port and filling the cylinder with air ready for the next charge of oil. Upon the right stroke of the piston, these inlet and exhaust ports are closed, the air compressed, and just before the piston reaches the end of the stroke, a jet of oil is forced in a fine spray through the fuel inlet nozzle in the head of the cylinder. The oil is sprayed against a hot plate on the end of the piston and is distributed instantly over the surface of the plate, gasified and ignited. It is claimed that the use of this hot-plate-ignition system increases the rapidity of the ignition and makes it possible to inject the fuel into the cylinder late in the stroke, thereby avoiding the abnormal pressures of preignition. Increased economy is secured by the use of water with the fuel oil. The water reduces the flame propagation, and thus keeps the initial pressure down to slightly more than the compression. It is also said to keep the cylinder free from carbon and the piston rings from sticking.

To start the engine the hot tube in the fuel cylinder head near the bottom is heated with a torch to red heat, the torch being removed as soon as the engine starts. The smaller-sized engines are started by hand, but the larger ones are equipped with an air starter, consisting of a small vertical air-cooled, single-acting air compressor, driven by a small gasoline engine, and an air receiver for 150-lb. pressure.

These engines are known as the "Giant" fuel-oil engines and are made in both single-cylinder and double-cyl-

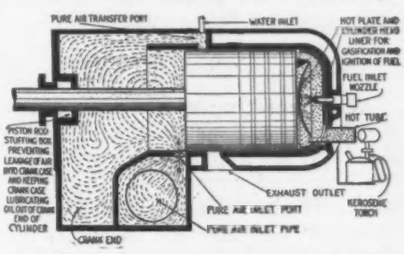

PURE AIR TRANSFER PORT
WATER INLET
HOT PLATE AND CYLINDER HEAD LINER FOR GASIFICATION AND IGNITION OF FUEL
FUEL INLET NOZZLE
HOT TUBE
PISTON ROD STUFFING BOX PREVENTING LEAKAGE OF AIR INTO CRANK CASE AND KEEPING CRANK CASE LUBRICATING OIL OUT OF CRANK END OF CYLINDER
EXHAUST OUTLET
PURE AIR INLET PORT
KEROSENE TORCH
CRANK END
PURE AIR INLET PIPE

FIG. 1—PISTON AT TIME OF COMBUSTION

inder models. The single-cylinder engines are made in sizes with ratings ranging from 12 hp. to 80 hp., while the two-cylinder models are built with ratings of from 60 hp. to 160 hp.

NEWS OF THE INDUSTRY

A Review of Activities in the Electrical Manufacturing, Selling and Central-Station Fields

Associated Manufacturers of Electrical Supplies Section

One June 8 the knife switch section, the porcelain section and the panelboard and switchboard section of the Associated Manufacturers of Electrical Supplies met at the Hotel Biltmore to elect officers, appoint committees and consider reports.

The knife switch section at this meeting nominated J. H. Trumbull, of the Trumbull Electrical Manufacturing Company for chairman, which nomination was passed upon by the board of governors, and the appointment confirmed. T. A. McDowell, of the Westinghouse Electric & Manufacturing Company was elected secretary, and P. J. Shelley, of the Metropolitan Electric Manufacturing Company, treasurer. The executive committee is: J. H. Trumbull, chairman, Trumbull Electric Manufacturing Company, Plainville, Conn.; P. J. Shelley, Metropolitan Electric Manufacturing Company, Long Island City; J. C. Dallam, General Electric Company, Schenectady, N. Y.; A. F. Hills, Crouse-Hinds Company, Syracuse, N. Y.; T. A. McDowell, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Knife Switch Section Standing Committees

The following standing committees were appointed: Committee on knife switches, mounted on porcelain.—J. C. Dallam, chairman, General Electric Company; F. V. Burton, Bryant Electric Company; W. T. Pringle, Pringle Electrical Manufacturing Company. Committee on knife switches, mounted and unmounted.—A. F. Hills, chairman, Crouse-Hinds Company; Fred B. Adam, Frank Adam Electric Company; Warren Ripple, George Cutter Company. Committee on disconnecting and miscellaneous knife switches.—T. A. McDowell, chairman, Westinghouse Electric & Manufacturing Company; H. F. Krantz, Krantz Manufacturing Company, Inc.; F. T. Wheeler, Trumbull Electric Manufacturing Company.

An industry conference committee to act with the Underwriters' Laboratories was appointed by the chairman of the section as follows: T. A. McDowell, Westinghouse Electric & Manufacturing Company; H. R. Sargent, General Electric Company; A. F. Hills, Crouse-Hinds Company. Many reports were made and much interest shown in the section work, and new activities suggested for future work.

Porcelain Section Meeting

At the meeting of the porcelain section J. E. Way, of R. Thomas & Sons Company, was nominated for chairman, and the appointment was afterwards confirmed by the board of governors. C. M. Semler, of the Pittsburgh High Voltage Insulator Company, was elected secretary and Herbert Sinclair, of the Star Porcelain Company, was elected treasurer.

Standing committees were appointed covering the various lines of porcelain manufacture, as follows: Line porcelain committee.—A. L. Wilkinson, chairman, Ohio Brass Company, Mansfield, Ohio; H. R. Holmes, R. Thomas & Sons Company, East Liverpool, Ohio; C. M. Semler, Pittsburgh High Voltage Insulator Company, Pittsburgh, Pa.; J. W. Cleveland, Locke Insulator Manufacturing Company, Victor, N. Y. Special porcelain committee.—B. B. Dinsmore, chairman, Imperial Porcelain Company, Trenton, N. J.; Herbert Sinclair, Star Porcelain Company, Trenton, N. J.; Charles Howell Cook, Cook Pottery Company, Trenton, N. J.; Charles H. Jensen, Empire China Company, Brooklyn, N. Y.; F. L. Bishop, Hartford Faience Company, Hartford, Conn. Freight classification committee.—B. F. McLean, chairman, Ohio Brass Company, Mansfield, Ohio; J. W. Cleveland, Locke Insulator Manufacturing Company, Victor, N. Y.; A. L. Jensen, Empire China Works, Brooklyn, N. Y.; C. W. Kettron, Illinois Electric Porcelain Company, Macomb, Ill.; B. B. Dinsmore, Imperial Porcelain Company, Trenton, N. J.; H. R. Holmes, R. Thomas & Sons Company, East Liverpool, Ohio.

Various reports were made showing the progress of the work and new activities discussed for future work.

Officers of Panelboard and Switchboard Section

The panelboard and switchboard section placed in nomination for permanent chairman Charles L. Eidlitz, of the Metropolitan Electric Manufacturing Company, which appointment was duly confirmed by the board of governors. D. K. Chadbourne, of the George Cutter Company, was elected secretary, and W. T. Pringle, of the Pringle Electrical Manufacturing Company, treasurer.

Standing committees were appointed by the chairman as follows: Panelboard committee.—F. T. Wheeler, chairman, Trumbull Electric Manufacturing Company, Plainville, Conn.; W. T. Pringle, Pringle Electrical Manufacturing Company, Philadelphia, Pa.; A. F. Hills, Crouse-Hinds Company, Syracuse, N. Y. Switchboard committee.—H. F. Krantz, chairman, Krantz Manufacturing Company, Inc., Brooklyn, N. Y.; A. C. Streamer, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.; Charles E. Wilson, Sprague Electric Works, New York City. Knife switch committee.—J. H. Trumbull, chairman, Trumbull Electric Manufacturing Company, Plainville, Conn.; Fred B. Adam, Frank Adam Electric Company, St. Louis, Mo.; T. A. McDowell, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. Cabinet committee.—A. F. Hills, chairman, Crouse-Hinds Company, Syracuse, N. Y.; Fred B. Adam, Frank Adam Electric Company, St. Louis, Mo.; F. T. Wheeler, Trumbull Electric Manufacturing Company, Plainville, Conn.

Line Material and Lighting Fixture Sections

The second meeting of the line material section was held at the Hotel Biltmore on June 23, at which time standing committees were appointed and other detail work was completed. A. L. Wilkinson, of the Ohio Brass Company, has been appointed permanent chairman of this section.

Edward A. McCoy, of J. B. McCoy & Son, New York City, has been appointed chairman of the lighting fixture section which was recently formed. The appointment of committees, etc., will be deferred until the next regular meeting in the early fall.

Activities of Massachusetts Contractors

The Electrical Contractors' Association of Massachusetts has issued 2000 booklets containing the State licensing laws, extracts from the constitution of the association and the names of all the licensed master electricians in the State, alphabetically arranged by towns and cities. Members of the association are in boldfaced type. Copies of the booklet are being mailed to architects, builders and electrical contractors and jobbers throughout Massachusetts by J. E. Wilson, the organization's special representative.

The association is issuing an "Occasional Letter" at least once a month, printed on a double folded sheet, punched ready for binding. This letter sets forth the doings of the association and forthcoming events, and offers suggestions in the interest of the association.

The annual convention of the State organization will this year be merged with a convention of contractors from all the New England States at Hartford, Conn., on Sept. 26-28. Sessions will be held in the Foot Guards' Armory, and there will be a large electrical show. H. W. Baldwin of Hartford is chairman of the committee of arrangements.

The provision in the Massachusetts law relating to the licensing of masters and journeymen electrician has been modified so that the five-year experience exemption no longer applies, and all applicants are required to take an examination. A result of the law is to weed out a large per cent of applicants who, under former conditions, were able to secure the coveted certificates.

A considerable number of manufacturers and jobbers are becoming members of the association as associates. The dues are the same as those for regular members, $20 a year, and all the privileges of the organization are available to associates except that of voting.

The Massachusetts Electrical Contractors' Association now has more than 100 members.

Public Service Commission News

Illinois Commission

In the tabulation of valuations, rates of return and rates of depreciation allowed by the commission in various rate cases passed upon that appeared on page 1323 of our June 3 issue, the rate of return in the case of Woll versus Hullinger should have read 7 per cent instead of 2 per cent.

Upon application of the Central Illinois Public Service Company the Public Utilities Commission approved a trial installation of a new style of rates for electric service rendered through limiters effective in the city of Olney, in capacities of 100 watts, 150 watts and 200 watts of demand. In a previous order the commission approved a trial installation of 100-watt limiters in the cities of Marion, Robinson and Lawrenceville. The commission, in commenting upon the merits of and the objections to the limiter and the rate applicable thereto, said:

"As to the propriety of the proposed rate, the commission at this time is making no finding. The said $1 per month, in a strict sense, is a flat rate; but the limiter places this rate under control in respect to the maximum demand of which the uncontrolled use has been one of the principal objections, from a central station point of view, to the old and nearly obsolete flat rates. In the cities where it is proposed to experiment with the limiter, the present electric rates are based on a maximum demand (active load), with a metered consumption, over and above a minimum bill of about $1 a month. It appears that the frugal people, living in small homes and possessed of only seven outlets, who may take advantage of the limiter rate, would hardly consume more energy, on an average, than would be represented by the minimum bill of the consumer who is connected through a standard watt-hour meter. It is to be admitted, however, that the flat rate, even though controlled by a limiter, may be subject to considerable abuse. Only trial, experimentation, data, and practical experience will disclose the facts of actual operation. There appear to be sufficient advantages, which, in the opinion of this commission, will warrant trial installations of the limiter in the aforesaid three cities."

After setting forth definite rules governing service through limiters, the commission required: (1) That the provisions of this order shall expire eighteen months from the date of the same, unless the said time of expiration is either revoked or renewed *ad interim*. (2) That the Central Illinois Public Service Company, in the experimental installations in the cities of Marion, Lawrenceville and Robinson, shall connect regular watt-hour meters and check the consumption of energy taken by not less than ten limiter customers in each of the three cities, and, at bi-monthly intervals, shall report to the commission the data and experience collected relative to the working of the limiter. In the event of a large number of limiter customers being secured, the check meters should be interchanged and distributed among the various customers.

Ohio Commission

A hearing on the valuation of the Cleveland Electric Illuminating Company's property took place before the Public Utilities Commission on June 15. Attorneys for the company were instructed to file their briefs by June 26, and the Cleveland city law department must have its briefs in not more than ten days later. The city council passed an ordinance reducing the service rate to 3 cents flat more than a year ago, but the company refused to accept it. The possibility of furnishing service at this rate will be determined by the final figures fixed by the commission. Members of the commission will make a personal inspection of the property on July 7.

Idaho Commission

It is probable that the next Idaho Legislature will be called upon to materially strengthen the public utilities law of the State by the addition of a number of amendments placing back into it some of the propositions that the Senate withdrew when the measure was attacked by that body after it had passed the House as one of the strongest of public utilities acts.

One of these amendments will propose the clothing of the commission with power to order and direct the sale of public utilities where the service to a community is unsatisfactory and other parties are prepared to install a system that has all the necessary facilities to render good service. Several situations have arisen in the past two years where, had the commission had power to take this action, serious and costly situations would not have developed.

When the utilities act was before the Legislature that enacted it into law the Senate extracted from the measure a provision allowing commission supervision of securities of public service companies to prevent wildcatting and to see that the funds raised went into the property. It is claimed that the commission could have used this power during the past two years very effectively.

There is a more friendly sentiment over the State expressed toward the commission now than there has been since its creation. There were several attacks made on the commission during the last session of the

Legislature, and one of these sought to repeal the law in its entirety. The Legislature, however, was not in that frame of mind. It is believed now that instead of attacking the law efforts will be made by many members of the Legislature to materially strengthen it through amendments.

California Commission

In considering the consolidated complaints and an application relative to the electric rates, rules, regulations, contracts, and practices of the San Joaquin Light & Power Corporation, it was found by the Railroad Commission that the utility could not require contracts as a condition to service under ordinary conditions, and that contracts for agricultural power were objectionable in certain features; that it was improper to require consumers to contract that bills should be a lien on their land, to waive damages, to grant rights-of-way, to pay in all instances according to the maximum demand, and to furnish transformers; that there was no serious complaint as to the quality of service; that the utility should relocate meter boxes at its own expense; that no order was required as to extensions, the utility having resumed its policy of making reasonable extension at its own expense; that discrimination in rates would be removed by the order; that the rates for agricultural power and commercial lighting were excessive; that residence lighting should be based on a block system with a monthly minimum of 75 cents, and ordered that the rates, rules, regulations, and contracts prescribed in the opinion should be put into effect, the rates being estimated to yield a return of 8 per cent, with a 6 per cent sinking fund depreciation annuity, on an ascertained valuation of $10,054,540, no allowance being made for early losses that had been recouped, or for franchises and water rights in excess of the cost and incidental expenses thereof. It was recommended that a contract to furnish service to the Mount Whitney Power & Electric Company, which was beneficial to neither, be abrogated and a new contract made.

An abstract of the commission's decision follows:

An electric utility can, unless a higher rate is paid for non-contract service, require contracts in the first instance as a condition precedent to agricultural power service in sparsely settled territory requiring unusually large investments, but the term should be for three years rather than five years, and continue only from year to year, and the contract should be subject to cancellation upon equitable terms, and should specify for the information of signers that appeal lies to the commission from unreasonable provisions. Contracts can be required to be signed as a condition precedent to oil well, mining power, and municipal street lighting electric service, in view of the uncertainty and hazards of the business or the relatively large investment required.

Farmers paying a flat rate for a maximum amount of electricity for irrigation pumps should be permitted to use the energy for other purposes when the pumps are not in use and the demand is controlled by a double-throw switch or other limiting device, although an occasional consumer may use energy in excess of his payment. An intending electric consumer cannot be required as a condition precedent to service to grant a free right-of-way over his premises for the distribution line beyond his installation.

Electric rates based on the connected load rather than the maximum demand are preferable for small consumers whose operating characteristics are well known. The maximum demand, as a base for an electric rate, should be taken by continuous readings of at least fifteen minutes rather than five minutes, and the charge should be for the period for which a bill is normally rendered rather than for the entire year.

Electric transformers should be supplied by the utility, even though the revenue may not justify the installation, since transformers are a necessary instrumentality in the rendition of service, and the utility can protect itself by the rate or by a guaranty.

No allowance can be made for going value in a rate case, other than considering tangible properties as being in successful operation by a going utility, where the revenues have been sufficient to wipe out early losses in addition to providing for an adequate depreciation fund and return on the investment and deficits. A valuation of hydroelectric water rights on the basis of the comparative costs of generating energy by water and by steam is of little merit, where the difference in costs varies with the shifting price of fuel oil used by the steam plant. In valuing hydroelectric water right on the basis of the comparative costs of generating energy by water and by steam, water generation cannot be taken at a lower cost than is used as the basis for fixing rates. No value can be given hydroelectric water rights on the basis of the comparative costs of generating energy by water and by steam, where water production will cost the more until fuel oil, used by the steam plant, advances 50 per cent in price, nor can water generation be taken at a lower cost than is used as the basis for fixing rates. Hydroelectric water rights cannot be valued on the basis of the capitalization of an assumed detriment to lower riparian irrigated land from the withholding of water by the utility's storage in the spring season, where the storage is a benefit to the lower irrigation. No allowance can be made on a rate case, in excess of moneys actually expended, for hydroelectric water rights resulting from a federal permit to construct a reservoir and flood government lands. An allowance of $328,624 was made for materials and supplies and $133,550 for working capital for the electric system of which the rate value is $10,054,540. A return of 8 per cent was allowed on the theory that a return should be sufficient to attract additional necessary capital, although the cost of money was only 6 per cent, and notwithstanding that extensive transmission and distribution lines had been built largely to hold the territory from a competitor. In fixing the amount of the annual depreciation allowance on the sinking fund basis, the commission stated it will not assume a return of only 4 per cent where it appears that the depreciation reserve is regularly invested in the plant upon which a return of 8 per cent is allowed.

Electrical consumers receiving service without a contract may be required to pay for the cost of the initial service connection, and disconnections and reconnections made at their request. A minimum bill for residence lighting was fixed at 75 cents per meter per month rather than at $1 per month. Intending electric consumers may be required to make application in writing for service, setting forth the location of the premises, the purpose of the service, a description of the equipment, the name and address of the person responsible for bills, and the relation of the applicant to the premises. A rate or schedule selected by an electrical consumer from other applicable rates and schedules should remain in effect until changed by thirty days' written notice from the consumer. Sub-meter or secondary electric meters may be charged for separately on a monthly rental basis where the rates are based on a supply from one meter. Electric meters should be furnished and installed by the utility at its own expense. An electric meter should not be used which has an error of registration in excess of 2 per cent under normal operation, the consumer having the right to require a test to be made in the presence of himself or of an expert, a reasonable charge to be made for tests occurring oftener than once in six months.

Massachusetts Tech Gets $2,667,000.—The Massachusetts Institute of Technology on June 14 announced gifts aggregating $2,667,000.

New Set of Safety Bulletins.—The National Safety Council is issuing a new set of public utility safety bulletins. The advance set consists of sixteen bulletins, fourteen of which show probable causes of electrical accidents, to be issued at the rate of one a week.

North Carolina Electrical Meet to Have Wiring Inspection Meeting.—Commissioner of Insurance James R. Young is planning a special convention of all electrical inspectors and representatives of the power companies doing business in North Carolina to make a special study of best methods of inspection and standards of excellence that should prevail in wiring and general electrical equipment. The convention is to be held early in July.

Cupples Plant Wins Case in St. Louis Courts.—A quo warranto suit against the Cupples Station Light, Heat & Power Company was recently refused by the St. Louis circuit attorney. Attorneys for the Union Electric Light & Power Company had requested that the suit be filed. A petition sent to the circuit attorney several weeks ago containing the signatures of property owners along the pole lines recently erected by the Cupples company, asked that the suit be entered. The circuit attorney said he would not file the suit because the case has already been settled by an injunction suit brought by a citizen.

Small Town Bills Collected at 2.5 Cents Each.—Because in many of the towns served by the Public Service Company of Northern Illinois there is not enough business to justify an office, collections are made through agencies which may be banks, department stores or other places of business. For this service a flat rate of 2.5 cents per collection is paid. There are many places of business in these small towns that would be glad to do the collecting free of charge, but it is the company's policy to ask a bond from the agency and to pay the same commission in all cases rather than accept any collection service gratis, since services which are paid for can be better regulated.

Illinois Commission to Make Rate Schedules Public.—The State Public Utilities Commission of Illinois has recently compiled and sent to the printer tabulations showing complete rate schedules of all utilities, other than railways and telephone companies, operating in all of the municipalities of the State of Illinois. The tabulations include the basic rates, lighting schedules, power schedules, municipal schedules, minimum bills, discounts, and other pertinent features relating to utility rates. The electric rate schedules when completely printed will total some 1300 pages, and the entire schedules will total approximately 2500 pages of printed matter. The electric schedules, gas schedules, water schedules and steam heating schedules are to be printed in separate volumes and will be ready for distribution to the public in the very near future.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Flood-Lighted Frontier Carnival.—What is advertised as the "world's first monster flood-lighted frontier night jubilee" will be staged at Havre, Mont., on July 4 to July 8. To light the carnival seventy-five 500-watt projectors have been purchased and will be installed on the lines of the Havre Electric Company.

Ohio Commission Spends $169,394 for Valuations.—Amounts expended by the Ohio Public Utilities Commission in the last eighteen months for the physical valuation of various public utilities in Ohio total $169,394.50, it was announced by the commission. In this amount is included the valuation of the following companies: The Union Gas & Electric Company of Cincinnati, $28,359.39; the Cleveland Electric Illuminating Company, $69,196.13; the Columbus Railway, Power & Light Company, $7,623.37; the Kent Water & Light Company, $1,176.83.

Another Cut in St. Louis Rates.—The Union Electric Light & Power Company of St. Louis, Mo., has reduced the maximum rate to residence customers from 9 to 8.5 cents per kilowatt-hour. Last August the company announced that when the number of its customers reached 65,000 the maximum rate would be reduced from 10 to 9 cents a kilowatt-hour and a further reduction from 9 to 8.5 cents would be made when the number reached 70,000. Another reduction to 8 cents is promised when the number of customers reaches 75 000. The company reduced its minimum rate last August from 6 to 3 cents per kilowatt-hour.

Why Lighting Companies Advertise.—S. B. Way, vice-president and general manager of the Milwaukee (Wis.) Electric Railway & Light Company, in a recent address before the members of the Advertisers Club, said that the Milwaukee Electric Railway & Light Company buys advertising space in the daily newspapers for two purposes: First, to increase its sale of light, power, heat and transportation, and second, to give its customers and the general public information about the business that it as a public servant believes the public is entitled to receive and must have in order to judge the service fairly. While some are perhaps under the impression that corporations buy advertising space in the daily newspapers to control editorial policy, Mr. Way said that "a daily newspaper that would sell its editorial influence in that way would soon have no influence to sell. It wouldn't be worth buying even if anybody was foolish enough to wish to buy it."

Penalty for Not Paying Bills Promptly.—Hereafter the Austin, Tex., user of water, light or power who neglects to pay his bill longer than fifteen days after the meter reading date will be penalized the sum of 25 cents. Although the penalty is small it is thought it will be sufficient to effect the result aimed at.

Embargo on the "Elektrotechnische Zeitschrift."—It is reported in *l'Industrie Electrique* on the authority of the Swiss *Elektroindustrie* that the German government has forbidden the transmission abroad of the *Elektrotechnische Zeitschrift*, the official organ of the German Elektrotechnische Verein and the Verband Deutscher Elektrotechniker.

Tax Valuation of Cleveland Property.—On June 17 the Ohio State Tax Commission announced that the tax valuation of the Cleveland Electric Illuminating Company for 1916 has been fixed as $20,014,380, an increase of $916,550 over the valuation of 1915. This is $2,926,733 less than the valuation made tentatively by the Public Utilities Commission for rate-making purposes, and the indications are that the advocates of a 3-cent rate will endeavor to use it in the fight for a lower valuation before the commission. However, the two commissions use different basis for making valuations and the tax commission does not employ engineers or attempt to make a technical valuation of Utility properties. Mayor Harry L. Davis has asked the City Council for an appropriation of $5,000 with which to employ experts to represent the city in the company's appeal of the 3-cent ordinance. He expressed dissatisfaction both with the appraisal made by the company and the commission.

Edward N. Hurley to Address the Third Annual Babson Conference on Co-Operation.—Although this conference is not to be held at Wellesley Hills, Mass., before the middle of September, already some excellent speakers have been secured. Edward N. Hurley, vice-chairman of the Federal Trade Commission, has accepted an invitation to speak, probably on the afternoon of Sept. 13. While not settled definitely it is hoped that Arthur J. Eddy of Chicago, author of the book "The New Competition," who spoke at the conference last year, will speak again this year. These two speakers and others will discuss the subject of co-operation between competing business men, or co-operative competition. Among the speakers already secured to discuss the subject of co-operation between employer and employee are Dean S. S. Marquis, head of the educational department of the Ford Motor Company, and N. O. Nelson of St. Louis who has practised profit sharing for twenty-eight years and built up his concern under that plan. It is also expected that Everett Morss, director of the First National Bank of Boston and president of the Simplex Wire & Cable Company of Cambridge, a concern which has had a successful profit-sharing plan in operation for fifteen years, will also address the conference.

Columbus Jovian League.—The annual picnic of the Columbus (Ohio), chapter of the Jovian Order was held at Buckeye Lake on June 21.

California Electrical Contractors.—It has been announced that the 1916 annual convention of the California Association of Electrical Contractors will be held at Stockton.

Pittsburgh Section I. E. S.—The final meeting of the season of the Pittsburgh Section of the Illuminating Engineering Society was held at the Pittsburgh Athletic Association on June 23. M. C. Turpin of the Westinghouse Electric & Manufacturing Company discussed some of the features of the lighting effects of the Panama-Pacific Exposition.

Kansas City Jovian League.—The third rejuvenation of the Jovian League of Kansas City was held on the steamer Chester on the evening of June 6. Fifteen candidates were received. Nearly 300 Jovians and their wives and daughters took the trip down the river and back. Prizes for women and children, contributed by jobbers and manufacturers, were distributed.

National Electrical Credit Association.—The seventeenth annual meeting of the National Electric Credit Association was held at the Hotel Traymore, Atlantic City, on June 23. W. E. Rice, credit manager of the Western Electric Company, New York, delivered an address on "Trade Acceptances." The remainder of the meeting was taken up by purely business matters.

San Francisco Electrical Development and Jovian League.—Willis Booth of Los Angeles, president of the Hotpoint Electric Heating Company, addressed the Electrical Development and Jovian League of San Francisco on June 7. The topic was broad in character and the speaker touched interestingly on the needs and the opportunities of the Pacific Coast and urged support for the Shields and Myers bills.

Cleveland Engineering Society.—At the annual meeting of the Cleveland Engineering Society on June 13, the first steps were taken toward erecting a club building to cost $200,000 and the collection of $400,000 for the endowment of a technical library. Members feel that they will be able to secure the funds for this purpose. The increase in membership last year was more than 400. F. W. Ballard, former heat and light commissioner of the city of Cleveland, was elected president of the society.

Southern Illinois Electrical Association.—At a meeting of the Southern Illinois Electrical Association held in Mount Vernon, Ill., on June 15 and 16, H. E. Brandli, general manager of the Citizens' Gas, Electric & Heating Company, of Mount Vernon, was elected president of the association for the ensuing year. H. A. Louwien, secretary of the same company, was elected secretary of the association. The next meeting of this association will be held in one of the cities in the southern part of the State some time this fall.

Associations and Societies

A complete Directory of Electrical Associations is regularly printed in the first issue of each month on the next-to-last text page.

Kansas City Section, A. I. E. E.—George C. Shaad, member for Kansas of the engineers board assisting in the "preparedness" census of industrial plants, addressed the Kansas City section of the American Institute of Electrical Engineers at its recent monthly meeting, telling of the progress of the work in that State. R. H. Barber of the Barber-Dwinnell Electric & Manufacturing Company, spoke on storage batteries, and the thirty members present discussed the chief causes of storage-battery troubles.

Great Western Power Section N. E. L. A.—The June meeting of the Great Western Power Company section of the National Electric Light Association was held on June 12 at the Oakland Commercial Club. The leading feature of the program was a demonstration of high-tension phenomena by Albert S. Lindstrom, sales manager of the Thordarson Transformer Company. The experiments covered a range of from 2 to 40,000 volts, and from a fraction of 1 amp. to 1500 amp. The program committee also arranged to have motion pictures of the laying of the third bay cable on March 13, together with a paper by John A. Koontz, Jr., engineer of the Great Western Power Company, entitled "Laying Power Cables Across San Francisco Bay."

Tri-State Water & Light Association.—At the sixth annual convention of the Tri-State Water & Light Association of the Carolinas and Georgia held at Charleston on June 21 and 22, the following topics came up for discussion: "Modern Distributing Transformers," by W. M. Gallant of Charlotte; "Improved Methods of Filtration," by R. E. Milligan of New York; "Esthetics and the Water Department," by A. J. Sproles of Greenwood; "Determining Pump Slip and Rate of Flow Through Pipes by the Use of Pitot Orifices," by F. C. Wyse of Columbia; "Standardization," by R. W. Shenton of Cleveland, Ohio; "The Inventor and the Lamp—Edison and the Development of Electric Lighting by Incandescent Lamp," by Vann Livingston of Atlanta; "The City Manager and His Responsibilities," by J. G. Barnwell, city manager of Rock Hill, S. C.

Engineering Education Promotion.—The twenty-fourth annual meeting of the Society for the Promotion of Engineering Education was held at the University of Virginia on June 19-22. The following was the scheduled program: Monday afternoon—address of welcome by Edwin A. Alderman, president, University of Virginia; report of committee on committees by H. S. Jacoby, chairman, Cornell University; report of institutional committee by G. R. Chatburn, chairman, University of Nebraska; report of joint committee on engineering education by Desmond Fitzgerald, chairman, Brookline, Mass.; report of progress on the study of engineering education by Dr. C. R. Mann, Carnegie Foundation for the Advancement of Teaching; report of joint committee on classification of colleges by C. S. Howe, president, Case School of Applied Science. Tuesday morning—report of committee on entrance requirements for engineering schools by J. J. Flather, chairman, University of Minnesota; report of committee on administration by F. H. Constant, chairman, Princeton University; "Student and Faculty Activities in a City Technical School," by Hollis Godfrey, president, Drexel Institute; "A Plea for the Further Study of Efficient Methods in the Administration of an Engineering College," by C. C. Morris, assistant to the dean, Ohio State University; report of committee on statistics by A. J. Wood, chairman, Pennsylvania State College; report of committee on the standardization of technical nomenclature by J. T. Faig, chairman, University of Cincinnati; "Graduate Courses for Practicing Engineers," by A. H. Blanchard, professor of highway engineering, Columbia University. Wednesday morning—report of committee on mathematics by L. C. Plant, chairman, Michigan Agricultural College; "The Meaning of Integration in Calculus," by James E. Boyd, professor of mathematics, Ohio State University; report of committee on physical sciences by D. C. Miller, chairman, Case School of Applied Science; "Teaching Chemistry at the University of Virginia," by R. M. Bird, professor of chemistry, University of Virginia; report of committee on mechanics and hydraulics by E. R. Maurer, chairman, University of Wisconsin. Wednesday afternoon—report of committee on English by S. C. Earle, chairman, Tufts College; report of committee on economics by J. A. L. Waddell, chairman, Kansas City; "Occupation and Distribution of Engineering Graduates," by A. A. Potter, dean, engineering division, Kansas State Agricultural College; "Engineering Education," by A. B. McDaniel, assistant professor of civil engineering, University of Illinois; "Research as an Element of the Growth and Progress of the School, (a) As an Aid to Teaching, (b) As a Means to Keep Instructors in a Condition of Growth, (c) For the Value of Results, (d) To Make Possible the Efficient and Economical Use of Laboratory Equipment," by P. F. Walker, University of Kansas. Thursday morning—report of committee on mining engineering by F. W. Sperr, chairman, Michigan College of Mines; report of committee on civil engineering by F. P. McKibben, chairman, Lehigh University; report of committee on mechanical engineering by A. M. Greene, Jr., chairman, Rensselaer Polytechnic Institute; report of committee on electrical engineering by C. F. Scott, chairman, Sheffield Scientific School.

FINANCE, COMMERCE AND INDUSTRY

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

Discounts on Heating Devices

Effect of License Agreement on Appliances Using Nickel-Chromium Resistance Elements

After Oct. 25, it is understood, electric heating devices in which the resistance element is made of nickel-chromium will be sold at such list prices and discounts as will insure a certain minimum net price. It is more than likely, however, that it will not be possible to reach this minimum net price by all routes.

With fundamental price considerations there should be little or no excuse for inferior or cheap appliances, provided, of course, all licensees live up to their license agreements. In the past each manufacturer generally established the price schedule on his own goods and sold at those prices or, if necessary, at lower prices to get the order. To cut list prices something must be sacrificed unless the article has been selling at too high a profit or unless quantity production would result from lower prices. Here has been perhaps the greatest source of complaint in the electrical heating device industry. Cheap prices necessitated sharp competition of the cut-throat variety and cheap products were made to look like better products with the result that dissatisfaction resulted. One central station in the East, during a recent canvass of its customers, found more than 1100 electric heating devices not in use in electrically lighted homes. All of these devices were out of order and needed repairing and were all of an inexpensive type.

With prices more uniform, however, as it seems probable they will be, and with price competition on certain goods virtually nil, it is evident that there will result a competition of product. Of course, it is not likely that manufacturers will be permitted to place fittings of any kind on their devices without charging for them at the market price. On the other hand, character of workmanship and quality of product naturally must remain with the producer. Under such conditions, the natural outcome would be that the different manufacturers would vie with each other in producing as good a product as was possible for a certain price and in accordance with the terms of the license.

All devices, it is understood, will be subjected to the same discounts with a basic discount of around 30 per cent. Additional discounts might then be expected by purchasers of large quantities of goods according (1) to the character of their business, (2) to the quantity delivered, and (3) to the time within which the account is settled. It has been intimated that jobbers will probably get the largest discounts, with central stations next, and the contractors, dealers and others who handle electrical goods in any quantity third.

The general range of discounts, including cash discount and discount for quantity orders at specified deliveries, it is reported, will not exceed 50 per cent for jobbers; 45 per cent for central stations, and 40 per cent for contractors, dealers, department stores, etc. The cash discounts probably will follow the general practice on payments within thirty days.

Contractor Good-Will Advertising

At the request of a number of member electrical contracting firms, the Society for Electrical Development is about to put out a series of special advertisements telling the reasons why it is desirable to patronize responsible contractors. The series is designed for use in local newspapers and while written primarily for local contractor associations, may be used equally well by individuals.

As a rule, contractor advertisements have up to the present been lacking in the good-will feature. Copy called attention to a certain stock or suggested house wiring, etc. The present series is designed to awaken in the public a desire for the best quality of workmanship and materials, although the price may be apparently high. A strong feature of the copy is its attempt to educate the people to thinking that the best is the cheapest in the long run. Aside from the fact that by inferior workmanship and goods certain contractors have been able by price cutting to take business away from more reputable firms, the latter now realize that this practice creates in the public a feeling of distrust toward the electrical contractor and his work.

South American Tariffs

Government Makes Report on Surtaxes, Penalties, Customs Requirements and Tariff Systems in Connection with Foreign Trade of Southern Republics

There is no greater obstacle to trade between nations than complicated and varying tariff systems. South American tariffs with their fines and penalties are among the most complex. The American exporter has never understood them, and thousands of inquiries on this score have led the Bureau of Foreign and Domestic Commerce, Department of Commerce, to prepare a report that covers exhaustively all the obscure points. It is the first complete report on the subject that has ever been made and is one of the most important of the recent attempts to promote a better understanding with South American countries and to increase our trade with them.

The report goes into the matter of surtaxes in great detail. It is a subject that has always bothered the American exporter. When money is wanted for some new project, an added tax on imports is the normal recourse in a number of South American countries. When a new public improvement is needed the quickest and easiest way to raise the money is to negotiate a loan guaranteed by the levy of a special duty or surtax. This is the history of practically all surtaxes. Either the customs revenue is found inadequate and a surtax is added, or some special expenditure is contemplated and resort is had to a surtax, the proceeds of which are allotted exclusively to that object.

The imposition of penalties is the point on which South American customs practice comes closest to the American exporter, and it is a point which has received extended consideration in the report. There are fines for delay in presenting documents, fines for failure to observe the formalities laid down by the regulations, for smuggling, for falsification of documents, and for various other acts of omission or commission on the part of the importer, which do not, however, directly affect the foreign exporter. American exporters are much more concerned with penalties imposed for failure to observe the consular regulations or for inexact statements in the consular invoice or the commercial invoice that lead the importer into declarations on his document that are deemed false and sometimes result in heavy fines. In such cases the importer naturally presents a claim against the American exporter for a refund of his loss. Unfortunately he frequently fails to make clear just what the trouble was and the American remains just as much in the dark as ever.

In most South American countries the appraiser, or other customs official, receives or shares in the proceeds from fines imposed. The purpose, obviously, is to stimulate the zeal of the employees in requiring an exact performance of the customs requirements. In practice the system seems to tend

to penalizing importers for unintentional violations of the regulations. In Argentina the appraiser who has recommended a fine is recognized as the defendant if the importer makes a protest, and if the protest is sustained may appeal to the Ministry of Finance. In Chile and Peru a bonus to all employees has been substituted for a share in the fines. In Bolivia there is a combination of the fine-sharing system and the bonus system.

The customs requirements as a rule are strict and must be followed precisely. They are based, in part, upon preliminary declarations of the foreign exporter, as registered in the consular invoice. All South American countries, except Argentina, Uruguay and Paraguay, demand the presentation of invoices, vised by a consular officer, before goods may be entered. In place of the consular invoice, Argentina and Paraguay accept a certificate of origin. In actual practice, however, a consular invoice usually accompanies shipments to Paraguay, and it is required by Uruguayan law in case of transshipments via Montevideo. In the invoice for shipments to Paraguay a declaration of the country of origin is made, and this is accepted as compliance with the requirement of a certificate of origin. In shipments to Argentina the certificate of origin usually omits the value of the goods, the declaration being confined to a description of the kind of merchandise and a statement of the countries where produced.

All other countries of South America are very strict in insisting upon the consular invoice, even those countries which have a tariff of specific duties and which, therefore, do not base the duties on the value of the goods. Colombia and Venezuela particularly require on the consular invoice all the information that must be shown on the entry or manifest.

In addition to the general summary, in which the tariff systems of the various countries are compared and many interesting and valuable conclusions advanced, the report contains a chapter for each South American country. In these chapters the various systems are set forth in great detail, not with a view to furnishing exact tariff rates, which are subject to constant change, but with the intention of making clear just how the laws are applied and the reasons for the various provisions. The subjects discussed under Argentina, for example, are as follows: Tariff-making authority, classification, dutiable weight, tariff relations with other countries, level of duties, additional duties, warehouse and custom handling, cranage, private charges, internal-revenue charges, free admission, export duties, consular documents, sentry, appraisement, warehouse requirements and privileges, pre-emption, penalties, appeals, importance of correct declarations, custom brokers, imports by parcel post, temporary admission and drawbacks, goods in transit, sanitary requirements, efforts toward tariff reform.

The report is entitled "Tariff Systems of South American Countries," Tariff Series No. 34, and will be on sale in a week or two at a nominal price by the Superintendent of Documents, Washington, and by the district offices of the Bureau of Foreign and Domestic Commerce.

New High Record for Exports

Exports from the port of New York made their highest record during the second week in June. A compilation by the foreign trade department of the National City Bank of New York shows that the total value of exports reported by the New York Custom House during the week ending June 10, 1916, was $92,000,000 against $25,000,000 reported in the second week in June, 1915, and $15,000,000 in the corresponding week of 1914, a period immediately preceding the war. The exports from New York now form nearly 60 per cent of the total merchandise exported from the country against about 36 per cent under normal conditions. More than three-fourths of the total went to Great Britain, France, Russia and Italy, the total to these four countries being, in round terms, $72,000,000, of which $41,500,000 was to Great Britain, $17,000,000 to France, $10,250,000 to Russia and $3,500,000 to Italy. To the same countries in the corresponding week of last year the total was $16,500,000 and in the corresponding week of 1914 approximately $5,000,000.

The principal articles forming this largest total ever exported from this port include explosives, $25,000,000; manufactures of iron and steel, approximately $15,000,000; manufactures of brass, more than $8,000,000; copper and manufactures, about $4,000,000; automobiles, approximately $3,000 000; oils, about $5,000,000; sugar, $4,500,000; manufactures of cotton, about $1,500,000, and leather and its manufactures, $1,500,000.

Automobiles, including parts, amounted to approximately $3,000,000, of which those classified as "Commercial" amounted to more than $1,000,000, passenger machines $600,000, the remainder being made up of tires, engines and parts of automobiles. The exports of automobiles and parts thereof in the corresponding week of 1914 amounted to but about $150,000.

Exports to South America for the second week in June were two and one-half times as much as for the corresponding week in 1915, and 50 per cent in excess of those during the corresponding week in 1914, amounting to $3,750,000 this year against less than $1,500,000 last year, and $2,750,000 in the corresponding week two years ago.

The exports of copper wire during the week ended June 10 last amounted to $124,490 compared with $16,727 during the second week of June, 1914. The exports of electrical machinery during the second week of June, 1916, amounted to $340,403 compared with $129,808 during the corresponding period of 1914.

During the month of May last there was exported to South America from the port of New York, electrical material to the value of $123,874 and electrical machinery to the value of $133,570, a total of electrical exports to South America of $257,444. It is stated in the compilation that about 85 per cent of the United States exports to South America go from the port of New York.

Trade Follows Capital, Not the Flag

How to capture the foreign trade of South America has been an absorbing topic with American manufacturers, particularly since the war to a large extent shut off from the southern republics their former source of supply. Numerous investigations have been made and reported upon by citizens of the United States, but American producers have heard little from South America itself indicative of its feeling in the matter.

In the opinion of Carlos A. Tornquist, a prominent banker of Buenos Aires, Argentina, credits play the most important role in cultivating the South American market. While speaking before the New York State Bankers' Association at Atlantic City a few days ago he said:

"There is no reason why the United States should not be placed on a footing of equality with Europe in relation to Argentine finance and business if the necessary modifications of your federal banking and trade laws are made along lines which would more largely facilitate banking and commercial operations between the United States and the Argentine. Financial credits naturally strengthen the exchange of the country which grants them.

"The experience of the foreign banks in the Argentine Republic has exploded the theory that 'trade follows the flag.' The results obtained there show that trade follows capital; and even in these early days of the investment of American capital in Argentine issues and enterprises there is ample evidence of the truth and soundness of the latter theory. But in order to convert this theory into practical form there are other essentials to be considered.

"There must be closer personal contact between Americans and Argentines. I want to see the inauguration of the first necessity of increased trade relations, and that is, the establishment of a service of first-class, comfortable and fast steamships that will make the trip from New York to Buenos Aires, and vice versa, in twelve to fourteen days. Extended intercourse between the leaders of the respective communities—not of their secretaries and employees—would do more good to foster and augment international commerce than any number of conferences or publications. We are seeing the extraordinary proportions reached lately in the trade between the two countries; and, although much of it doubtless owes its existence to war conditions, a great part of the advance has been the result of closer personal

investigation and of the exercise of more vigorous efforts on the part of American manufacturers than previously were put forth.

"Still, since my stay in the United States I have seen in the columns of the press an undercurrent of suspicion and mistrust, with more than open reference to the necessity for official protection, even by force, for American investors in South American countries. Speaking for my own country, let me say, gentlemen, that the great and close relations built up by Europe with the Argentine Republic have been established principally on the basis of mutual confidence; and unless the Americans are prepared to show the same confidence as has been shown by the financial and mercantile communities of Europe—a confidence justified by long experience—they had better not waste their time or their money in the effort to capture a larger share of our trade."

Copper and the Mexican Crisis

There has been considerable speculation regarding the probable effect of the Mexican situation on the copper market. That the requirements of the government will be a tax on the market is unlikely in spite of the expressed fears of many. In comparison with the forces in action in Europe the troops that would face each other in Mexico should war be the outcome of the present situation will be very small in number. Furthermore, it is highly improbable that a whole year's conflict in Mexico would use up as much ammunition as the daily consumption on the Verdun battlefield.

There is, however, a very definite possibility in the event of war of a stoppage of Mexican copper production and shipments. The Greene-Cananea and the Phelps-Dodge mines, two of the largest American interests in Mexico, have a combined monthly output of more than 9,000,000 lbs. of copper. Both of these interests would probably shut down on the declaration of war, but it is expected that they will not be closed very long. Being close to the border it is felt that American troops will be able to offer protection quickly. In that event, there is reason to believe that the production of these properties will increase principally owing to the greater freedom of operation and the lessened probability of labor disturbances.

There is very little activity in the market and while prices have gone down somewhat they are hardly an indication of the degree of stagnation in buying. Electrolytic copper went as high as 31 cents a pound during the earlier months of the year, but for some weeks has been dropping off. The price early this week had fallen to 27 cents, a decrease of 4 cents a pound from the high for the year, or 12.9 per cent. These are nominal quotations for prompt deliveries. Quotations for future deliveries have also fallen off, but not to the extent of those for prompt deliveries.

Manufacturing and Industrial

The E. A. Bruce Electric Company.—The name of the Bruce-Heustis Electric Company, Fitchburg, Mass., has been changed to the E. A. Bruce Electric Company.

The Wirt Company, Germantown, Philadelphia, Pa., manufacturer of dimming devices, announces that the Benjamin Electric Manufacturing Company, 590 Howard Street, San Francisco, Cal., is now acting as its Pacific Coast sales representative.

The United Battery Corporation has recently established new offices in the Woolworth Building, New York City. The company announces that it has materially increased its manufacturing facilities and that it has separated its executive offices from its factory.

The Boos Machine Company, St. Marys, Ohio, manufacturer of oil and gas engines, has purchased the plant formerly occupied by the St. Marys Machine Company, and will operate under the name of the Boos Machine Company, successor to the St. Marys Machine Works.

Cutler-Hammer Company Increases Price of Its Products.—Owing to the increase in the cost of materials, the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., is sending out a revised discount sheet applying to prices given in its catalog which shows a general rise in prices of approximately 10 per cent. For a period of thirty days from June 12, 1916, however, bonafide outstanding quotations which have been made prior to that date will be protected.

Century Electric Buys Property.—The Century Electric Company has bought the five-story building at 1817-1825 Pine Street, St. Louis, Mo., immediately adjoining the new seven-story addition to the Century factory. The consideration, it is understood, was $100,000. The lot fronts 100 ft. on Pine Street, and has a depth of 109 ft. northwardly. The building, which has an area of 65,400 sq. ft., is occupied, but when the lease expires in 1917 it is thought the Century Electric Company will annex it to its plant.

Rapid Growth of Kansas City Exide Depot.—The Electric Storage Battery Company has moved into its new two-story Kansas City Exide Depot at the corner of Seventeenth and Walnut streets. The depot opened in 1912 in a small store at 1329 Walnut Street, having 2500 sq. ft. of floor space and one employee. In 1912 the depot was taken to 1708 Main Street, where five employees had 5000 sq. ft. of floor space. The new quarters have 15,000 sq. ft. of space and between twelve and fifteen persons, it is expected, will be employed.

Electric Vehicles Selling Well in Small Towns.—The first five months of 1916 showed a remarkable gain in the sales of electric automobiles in the Missouri valley, according to A. T. Clark, manager of the branch of the Anderson Electric Car Company, who said that the business of the branch had shown an increase of 281 per cent over the same period in 1915. He was particularly pleased over the greater sales in small towns, which previously had not been worked by electric car companies. "We had never done much work in small towns, believing that they were not a profitable field for us," he said. "We find, however, that the central stations are eager to co-operate with us and that the time is ripe to work that field." Towns of 500 to 10,000 population are rapidly getting modern improvements of paving and electric light plants, and each is also rapidly acquiring electric cars.

The Edison Storage Battery Supply Company has established a new sales office at New Orleans and has appointed C. A. Luckey as resident manager. Mr. Luckey was graduated from Franklin (N. Y.) Military Academy in 1899, and attended the Bliss Electrical School, Washington, D. C., in 1900 and 1901. He was connected with the Western Electric Company, New York City, during 1901 and 1902, leaving that concern to go with the Safety Car Heating & Lighting Company, with which he remained until 1911, spending the first four years in the company's electrical laboratory and then going with the Chicago branch of the concern. In 1911 Mr. Luckey was connected with the Railway Utility Company, Chicago. In 1912 he joined the sales force of the Edison Storage Battery Company, Orange, N. J., and was attached to the sales office in Chicago, where he has been until his present appointment. Mr. Luckey's new address will be the Edison Storage Battery Supply Company, 201 Baronne Street, New Orleans, La.

Orders for Mechanical Soot Cleaners.—The Vulcan Soot Cleaner Company, Du Bois, Pa., reports that its New York representative, the De Ved-Kissick Company, has recently obtained what is claimed to be the largest order on record for the type of apparatus manufactured by the Vulcan company. Vulcan soot cleaners are to be installed on fifty boilers of the Babcock & Wilcox type, totaling 30,000 hp. rated capacity, at the Marion plant of the Public Service Electric Company of New Jersey. In this plant the boilers are set singly with dusting and blow doors on each side, through which a hand steam lance could be inserted for hand blowing; it was considered more economical, however, to equip the plant with mechanical soot cleaners. The same company has also recently equipped its 1375-hp. boilers for the new Essex plant with Vulcan soot cleaners. This is the fifth order received from the Public Service Electric Company. Other large orders have recently been received by the Vulcan Soot Cleaner Company from the Calumet Hecla Mining Company, the Youngstown Sheet & Tube Company, the Duquesne Light Company, Pittsburgh, Pa.; the Merrimac Manufacturing Company, Lowell, Mass.; the Consolidated Gas & Electric Company, Baltimore, Md.; the North American Chemical Company; the Buffalo General Electric Company, and the Chicago & Northwestern Railroad.

Lake Freighter Carries Its Own Electric Lifting Magnets for Loading Pig Iron.—Although electro-magnets have been in use at ore docks a number of years for unloading pig iron, the loading has always been accomplished by means of gangs of longshoremen. The successful and economical performance of magnets when unloading convinced the Charcoal Iron Company of America that a similar means of loading would be of equal advantage. After buying the lake freighter, John Sharples, and renaming it the Cicoa, the company fitted it with the same kind of Cutler-Hammer circular magnets—but of 36-in. size—and recently used them for taking on the first cargo at Ashland, Wis. The powerful magnets swing out over the dock from the crane, and as they near the pile of pig iron the pigs fairly jump toward the magnet and are carried away to be dropped when the operator throws off the switch. The boat's crew store the iron in the hold. According to Capt. James H. Gallagher, the services of a gang of longshoremen were dispensed with and the entire cost of putting on the cargo of 4,000,000 lb. (2000 tons) was only $100. The cost of loading with longshoremen would have been from $500 to $600—making a saving of from $400 to $500 every time the vessel is loaded. With all three magnets working the net weight of pig iron lifted from the dock is 4500 lb. The Cicoa will be employed exclusively in carrying pig iron from the company's docks at Ashland, Manistique, Boyne City and Newberry, Mich., to Buffalo. The magnets were furnished by the Cutler-Hammer Clutch Company of Milwaukee.

Swedish Electrical Jobber Desires American Manufacturing Connections.—John A. Diehl, a Swedish electrical engineer, has been on a visit to the United States, representing his father, H. J. Diehl of Malmo, Sweden, who is just opening a wholesale and jobbing business in electrical supplies and equipment at Malmo, which is a city of 100,000 population in the southern part of the Scandinavian kingdom. Mr. Diehl came here to make closer business connections with American manufacturers of electrical supplies. He is interested in getting prices on large quantities of lamp sockets, switches, plugs, wire, arc-lamp carbons, commutator brushes, and other apparatus and supplies which can be purchased in America more cheaply than they can be manufactured in Sweden. Electric heating devices, for example, explains Mr. Diehl, do not fall in this class, for Swedish and European manufacturers are able to build much more cheaply than American makers. As a result, electric irons are sold wholesale in Sweden at quantity prices as low as 50 cents per iron. Sweden is just beginning to apply its many waterfalls for the generation of electrical energy, and throughout the country, in the towns and cities as well as on the farm, the use of electricity is rapidly gaining ground. As a result of the war Germany is unable to supply Sweden's demands for electrical equipment, and Sweden is now more than ever looking to America for supplying the needed electrical articles. Mr. Diehl planned to sail for home on June 20, on the steamer Stockholm, and may be addressed at his office at Malmo, Sweden, by American manufacturers. Later he may make another business trip to America.

NEW YORK METAL MARKET PRICES

	June 13 Selling Prices Bid	Asked	June 20 Selling Prices Bid	Asked
Copper	£ s d		£ s d	
London, standard spot	121 0 0		106 0 0	
Prime Lake	27.75	to 28.80†	26.75	to 27.25†
Electrolytic	27.75	to 28.00†	26.75	to 27.25†
Casting	25.50	to 25.75†	24.50	to 24.75†
Copper wire	31.00	to 31.50†	30.00	to 31.00†
Lead	7.00		7.00	
Nickel	45.00	to 50.00	45.00	to 50.00
Sheet zinc, f.o.b. smelter	20.00†		20.00†	
Spelter	13.42½	to 13.67½	12,30	to 12.55
Tin, straits	43.50		40.75	
Aluminum, 98 to 99 per cent	58.00	to 60.00	61.00	to 63.00

OLD METALS

Heavy copper and wire	20.50	to 21.00†	20.00	to 20.50†
Brass, heavy	12.00	to 12.50†	12.50	to 12.75†
Brass, light	10.00	to 10.25†	9.50	to 10.00†
Lead, heavy	5.37½	to 5.62½†	5.37½	to 5.62½†
Zinc, new scrap	10.00	to 11.00†	8.00	to 8.50†

COPPER EXPORTS

Total tons to June 20 23,917

†Nominal.

Corporate and Financial

Arkansas Light & Power Company, Arkadelphia, Ark.—An issue of $350,000 of 7 per cent cumulative preferred stock is being offered at par with a 20 per cent common stock bonus.

Federal Light & Traction Company, New York City.—The consolidated statement of profit and loss of the company and its subsidiaries for the years ended Dec. 31, 1914 and 1915 shows for the later period a decrease in gross earnings of $64,945, or 2.7 per cent, and in total income a decrease of $82,354, or 9.3 per cent. The decrease in gross earnings was caused principally by a reduction in gas sales of $21,196; also by a reduction in water sales of $11,744 and by a reduction in railway earnings of $146,356 principally attributable to jitney competition. The foregoing and other reductions in gross earnings, aggregating $179,615, were partially offset by an increase in gross earnings of the electrical department of $113,189, or 8.4 per cent, and by an increase of $1 481 in the steam heating department, or 15.6 per cent. The decrease in total income was caused principally by a reduction in net earnings in the gas department of $7,409, owing to reductions at Hot Springs and Springfield totaling $11,417, partially offset by gains at Albuquerque, Trinidad and Tucson; and also by a reduction in net earnings in the railway department of $137,850. Every effort was made to reduce the railway operating expenses but, owing largely to floods at Trinidad necessitating extraordinary expenditures for maintenance, the reduction in operating expenses in the railway department for the year amounted to but $8,500. The foregoing and other reductions in total income, including a reduction in Federal Company income of $22,471, aggregating $168,321, were partially offset by an increase in net earnings in the electrical department of $82,194, or 16.1 per cent, and by an increase in net earnings in the water department of $3,772, or 11.8 per cent. A consolidated statement of earnings of the company and subsidiaries for the years ended Dec. 31, 1915 and 1914, excluding depreciation, follows:

	1915	1914
*Gross earnings	$2,352,015	$2,416,960
Operating, administrative expenses and taxes	1,545,716	1,528,307
Total income	$806,299	$888,653
Interest charges	589,342	586,155
Central Arkansas Railway & Light Corporation dividend	84,000	84,000
Springfield Railway & Light Company dividend	23,890	.....
Federal Light & Traction Company dividend	.....	112,500
Balance	$109,067	$105,998

*Intercompany earnings, expenses and interest charges have been excluded.

International Electric Light, Heat & Power Company, Philadelphia, Pa.—This company, which is a subsidiary of The American Railways Company, which in turn is controlled by the National Properties Company, has filed with the New Jersey Public Utilities Commission an application for approval of its purchase of more south Jersey electric properties. In addition to the Bridgeton Electric Company, the Electric Company of New Jersey, operating in Salem, Woodbury, Pitman and Glassboro; the Williamstown Electric Company, and the Pennsgrove Electric Light, Heat & Power Company, all of which it now controls, the International company has bought out the Woodstown Ice & Cold Storage Company and the Clementon Township United Electric Improvement Company, thus completing the purchase of practically all of the electric plants in western south Jersey with the exception of the municipally-owned system at Vineland and the Millville Electric Company, which is owned by the R. D. Wood interests.

Iowa River Light & Power Company, Eldora, Iowa.—An issue of $200,000 of first mortgage sinking fund 6 per cent gold bonds dated May 1, 1916, and due May 1, 1936, is being offered at par and interest.

Northern Ohio Traction & Light Company, Akron, Ohio.—The statement made in the Cleveland *News* of June 13 to the effect that negotiations had been resumed by Eastern bankers for the purchase of the controlling interest in the Northern Ohio Traction & Light Company is authoritatively denied in New York.

Northwestern Ohio Light Company.—The company has filed a mortgage for $435,000 in favor of the State Street Trust Company of Boston in the recorders' offices in Putnam, Allen, Champaign, Clark, Wood and Henry counties, Ohio, in order to secure an issue of bonds of about the same amount, the proceeds to be used in consolidating all its properties under one management.

Ohio Gas & Electric Company, Cincinnati, Ohio.—The capital stock of the company has been increased from $1,000 to $1,500,000.

Pennsylvania Utilities Company, Easton, Pa.—An issue of $3,000,000 of first mortgage 5 per cent sinking fund gold bonds, dated April 1, 1916, and due April 1, 1946, is being offered at 95 and interest.

Portland (Ore.) Railway, Light & Power Company.—The accompanying earnings statement, following the unfavorable statement for the previous year, is decidedly unsatisfactory and is indicative of the distressing conditions under which the property has been operated during the past year, it is stated by F. T. Griffith, president of the company, in his annual report. These conditions and the order of their importance have been as follows: (a) General business depression prevailing in the States of Oregon and Washington and especially acute in the western half of said States, covering the territory in which this company operates; (b) unlicensed and unregulated competition from jitneys, beginning immediately after Jan. 1, 1915, and continuing throughout the year without restrictions or regulation of any kind; and (c) continued electric light and power competition from the Northwestern Electric Company. "The general depression in business in the Pacific Northwest," says Mr. Griffith, "has been more pronounced during almost the entire year than in any other portion of the United States, this condition being strikingly in contrast with the sharp renewal of activity in the Eastern and Middle States. The effects of the jitney competition are shown by the decrease in gross earnings of the railway department of $492,000, and the net earnings of $419,000, a very large part of which was due to the jitneys. The number of passengers carried in 1915 was 78,704,913 as compared with 89,934,644 in 1915. Since Feb. 8, however, there has been a steady improvement in street railway earnings averaging about 6 per cent above the previous year, and we believe our stockholders may reasonably expect that each of the following months of the year 1916 will show increases of street railway earnings over the corresponding months of 1915. In the light and power department the competition of the Northwestern Electric Company continued throughout the year at rates somewhat lower than our schedules. Our loss in gross earnings from light and power business is due entirely to this competition, but attention is called to the fact that the decrease amounted to $229,500 in the first six months of 1915 as compared to 1914, and to only $21,500 during the last six months of 1915. In the months of November and December, 1915, there were small increases in gross earnings as compared to 1914. At the close of 1915 we were serving 38,230 customers, an increase of 292, compared with Dec. 31, 1914. We expect to increase the number of customers and our sales during 1916. Encouraging features in this department are the large number of new customers connected up during the past ninety days, the securing of several large industrial power contracts since the first of 1916, and the excellent prospect of securing additional load. With improving conditions in our light and power earnings and increases in our street railway earnings, due to gradual elimination of the jitneys and better business conditions, it should be possible to show a substantial surplus during 1916 over and above all charges and this 15 per cent maintenance fund. No large capital expenditures are contemplated for 1916, as the company is well equipped to handle all new business in sight. It is not believed that construction costs for 1916 will exceed the figures for the year just closed, namely, $212,372, unless it is found desirable to extend the tracks of the company over the new bridge which is being constructed between Oregon and Washington, across the Columbia River at Vancouver, and to extend our transmission line system from Mount Angel to Salem, to provide for the power requirements of the Southern Pacific Railroad brought about through extension of the electrification of its railway lines. The total capital requirements in any event will not be large and will be confined to such construction work as cannot be avoided, or is necessary to properly protect the business of the company.

A comparative earnings statement for 1915 and 1914 follows:

	1915	1914
Gross earnings	$5,511,345	$6,273,171
Operating expenses	2,542,278	2,695,356
Net earnings	$2,969,067	$3,577,815
Taxes	$531,351	$568,527
Bridge rentals	47,752	45,198
Interest	2,160,603	2,127,480
Total fixed charges	$2,739,706	$2,741,205
Surplus	$229,361	$836,610

Rome (Ga.) Railway & Light Company.—A block of $850,000 of first mortgage 5 per cent gold bonds, being part of an authorized issue of $3,000,000 dated April 1, 1916, and due April 1, 1946, is being offered at 96 and interest yielding about 5.25 per cent.

Rockingham County Light & Power Company, Portsmouth, N. H.—The company has been given authority by the New Hampshire Public Service Commission to issue $750,000 face value of its negotiable gold bonds to be secured by a mortgage and to be dated July 1, 1916. The company intends to retire an outstanding issue of bonds amounting to $600,000 and to pay indebtedness incurred in the acquisition and construction of property of the company in New Hampshire to the amount of $150,000.

Utah Light & Traction Company, Salt Lake City, Utah.—A statement of earnings for the twelve months ended March 31, 1916, follows:

Gross earnings	$1,420,887
Operating expenses and taxes	945,163
Net earnings	$475,724
Other income	361,817
Total income	$837,541
Interest charges and other deductions (net)	812,165
Balance	$25,376

Utah Power & Light Company, Salt Lake City, Utah.—The total population served by the company and the Western Colorado Power Company, a subsidiary, is estimated at 250,000. The total number of customers served and other statistics as of March 31, 1916, follow:

Electric customers	51,926
Gas customers	1,471
Total customers	53,397
Installed generating capacity (kilowatts)—hydroelectric	106,550
Installed generating capacity (kilowatts)—steam	26,300
Installed generating capacity (kilowatts)—total	132,850
Generating capacity under construction (kilowatts)—all hydroelectric	17,500
Kilowatt-hour feeder output	303,156,891

The company and its subsidiary own hydroelectric generating stations with a total installed capacity of 90,400 kw. and steam-electric generating stations with a total installed capacity of 1800 kw. The electric generating stations leased from the Utah Light & Traction Company have a combined rated capacity of 29,800 kw., of which 13,800 kw. is hydroelectric and 16,000 kw. steam. The company also holds under long-term leases steam station capacity of 8500 kw. and hydroelectric capacity of 2350 kw. The total installed capacity of the plants owned and leased is 132,850 kw., of which 106,550 is hydroelectric and 26,300 is steam. A statement of earnings for the twelve months ended March 31, 1916, with a comparison for the previous twelve-month period, follows:

	1916	1915
Gross earnings	$3,772,852	$2,392,619
Operating expenses and taxes	1,895,342	1,208,713
Net earnings	$1,877,510	$1,183,906
Bond interest and discount	714,782	542,932
Other interest (net)	297,848	242,566
Balance	$864,880	$398,408

NOTE: The above statement shows the earnings for the entire period of all properties now owned, irrespective of the dates of their acquisition, and the earnings since Jan. 1, 1915, of the electric light and power and gas properties owned by the Utah Light & Traction Company and now leased to the Utah Power & Light Company.

New Utility and Industrial Companies

The Wight Electric Recorder Company of Cleveland, Ohio, has been chartered with a capital stock of $30,000 by J. R. Raible, W. C. Hopkins, John Y. Brooks, H. W. Ewing and A. Frank Counts.

The Mills & Lupton Electric Supply Company of Chattanooga, Tenn., has been incorporated with a capital stock of $25,000 by G. B. Adams, M. R. Stern, S. E. Stern, J. C. Stickney and J. L. Foust.

The Twin Valley Light & Power Company of West Hamilton, Ohio, has been chartered with a capital stock of $20,000 by Amos M. Fudge, J. E. Flora, Amos E. Brubaker, William A. Nock and O. E. Stiver.

The Sugar Creek Township Power Company of Franklin, Pa., has been chartered with a capital stock of $5,000 to operate in Venango County. The incorporators are John B. Brooks, Joseph McCormack and M. C. Cornell of Erie.

The Texas Prepay Fan Company of Dallas, Tex., has been incorporated by E. H. Thornhill, W. H. Hidell and W. I. Matheny. The company is capitalized at $20,000 and proposes to supply electricity for lamps, heaters and motors.

The Kunde Electric Supplies Company of Pittsburgh, Pa., has been chartered with a capital stock of $10,000 by E. H. Kunde, H. H. Kunde, W. A. Kunde, F. M. Beeman, John C. Hilf of Pittsburgh, Pa., and C. J. Kunde of Bellevue, Pa.

The Colonial Electrical Company of Newport News, Va., has been incorporated with a capital stock of $15,000 (maximum). The officers are S. B. Batte of Norfolk, president, and W. L. Cooke of Newport News, secretary and treasurer.

The Artistic Lighting Fixture Corporation of New York, N. Y., has been incorporated by N. W. Coan, M. Shuman, S. H. Shinsky, 120 West 117th Street, New York, N. Y. The company is capitalized at $25,000 and proposes to deal in electric lighting and gas fixtures.

The Concordia Light & Power Company of Concordia, Mo., has been incorporated with a capital stock of $15,000 to supply electricity for lamps and motors and to deal in electrical appliances. The incorporators are W. S. McCall, R. W. Morrison and Harry C. Loehr.

The Saylor Electric & Manufacturing Company of Wheeling, W. Va., has been incorporated with a capital stock of $25,000 by Frank D. Saylor, W. L. Saylor of Wheeling; C. C. Saylor of Wardwood; John C. Colburn of Neffs, Ohio, and Harry Sharp of Bridgeport, Ohio.

The Rice & Walden Electric Company of Hartford, Conn., with a capital stock of $2,000, was incorporated to do a general electrical contracting business. The incorporators are Willard A. Rice, A. E. Walden and V. A. Sykes. The company is located at 306 Pearl Street, Hartford.

The American Switch & Rheostat Company of Philadelphia, Pa., has been incorporated by F. R. Hansell of Philadelphia, Pa.; George H. B. Martin and S. C. Seymour of Camden, N. J. The company is capitalized at $200,000 and proposes to manufacture switches, rheostats and appliances for regulating and generating electricity.

The Electrolytic Oxyhydrogen Laboratories, Inc., has filed articles of incorporation with a capital stock of $10,000 for the purpose of manufacturing oxygen, hydrogen, chemicals, electrolytic products, apparatus, etc. The incorporators are H. M. Wallace, I. N. Hoffman and W. A. Holgerson, 336 East 166th Street, New York, N. Y.

The K. P. Manufacturing Company of New York, N. Y., has been incorporated by L. Wickes, 493 Gramatin Avenue, Mount Vernon; E. Knause, 250 West Fifty-fourth Street; T. J. Byrne, 55 Liberty Street, New York, N. Y. The company is capitalized at $25,000 and proposes to manufacture auto accessories, electrical and mechanical appliances, etc.

The Glens Falls Electric Installation Company of Glens Falls, N. Y., has been chartered with a capital stock of $5,000 for the purpose of conducting a general electrical and mechanical engineering business and to construct and install electrical machinery, devices, etc. The incorporators are William H. Lamont, F. Robert Twiss and Clifford M. Marsh of Glens Falls, N. Y.

Trade Publications

Electric Blackboard-Eraser Cleaner.—The Wisconsin Electric Company, Racine, Wis., has prepared a folder which contains information on its blackboard-eraser cleaner.

Coal Crusher and Sampler.—The Sturtevant Mill Company, Boston, Mass., is sending out Bulletin No. 85, which contains information on an electrically operated automatic coal crusher and sampler.

Wiring Devices.—The Crouse-Hinds Company, Syracuse, N. Y., is sending out a folder which directs attention to a 112-page catalog recently published and entitled 'One Hundred Condulet Suggestions."

Electric Supplies.—The Illinois Electric Company, 308 Madison Street, Chicago, Ill., is sending out Catalog No. 21, which contains a net price list and discount sheet of various products which the company is handling.

Talking-Machine Motor.—The Victor Electrical Equipment Company, 248 Boylston Street, Boston, Mass., has prepared an illustrated folder which contains information on the "Vesco" electric drive for talking-machines.

Lighting Fixtures.—"Exempler Campaign Fixture Sets" is the title of a catalog issued by Pettingell-Andrews Company, Pearl Street and Atlantic Avenue, Boston, Mass., which contains information on ornamental lighting fixtures.

Turbo Generators.—Curtis turbo-generators are very fully described in an attractively illustrated eighty-eight-page catalog designated as List No. 1100 and issued by the British Thomson-Houston Company, Ltd., Rugby, England.

Electric Washer.—The Crystal Washing Machine Company, Detroit, Mich., is sending out an illustrated catalog printed in colors which contains information on its Model No. 5 cylinder-type electric washing machine which was recently described in these columns.

Inspected Electrical Appliances.—The Underwriters Laboratories, Inc., 207 East Ohio Street, Chicago, Ill., is sending out its April, 1916, list of Inspected Electrical Appliances. Both this list and a list of manufacturers of inspected mechanical appliances are published semi-annually.

Lightning Arresters.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued Catalog I-A on various types of lightning arresters. The catalog also contains a discussion of lightning and its effects and information on the application of lightning arresters.

Air Compressors and Vacuum-Cleaning Apparatus.—The Blaisdell Machinery Company, Bradford, Pa., has just issued a large-sized general catalog which is profusely illustrated and which contains a considerable amount of information on various types of air compressors and stationary type vacuum-cleaning systems.

Flash Lamps.—The Usona Manufacturing Company, 1 Hudson Street, New York, has prepared three attractively illustrated folders containing information on its "kwik-lite" line of flash lamps and suggesting in what ways the devices may be utilized. One folder directs attention to the uses of flash lamps in the home, another by automobilists, and another on vacations.

Traveling Water Screens.—The Chain Belt Company's (Milwaukee, Wis.) latest folder, No. 64, is attractively illustrated and contains information on traveling water screens designed primarily to remove refuse and foreign material from water before it enters power plants, steel mills, or any other industrial plants, requiring large quantities of clean water.

Storage Batteries.—The Cook Railway Signal Company, 1793 South Broadway, Denver, Col., has issued Catalog No. 2 on its "ReVivo" storage battery for lighting and ignition service; Catalog No. 3 on electric lighting plants; catalog No. 4 on storage batteries for electric vehicles, and Catalog No. 5 on its "Armorclad-Revivo" electric storage batteries for self-starting and lighting service.

New House Organ.—The first issue of The Nitrolite has just been published by the Harter Manufacturing Company, Chicago, Ill. The object of the new publication, it is stated, is not only to entertain the trade by light quips and quirks, but to lend a hand as well. It will be not only a house organ but also a house bulletin, and will contain descriptions of new goods, give changes in prices and other data.

New England

BATH, ME.—The Central Maine Power Company of Augusta has awarded a contract to Andrew S. Merrill of Bath to erect an electric transmission from Bath to Gardiner, a distance of 30 miles.

ELLSWORTH, ME.—The Bar Harbor & Union River Power Company of Bar Harbor will soon begin work on the rebuilding of its entire local system.

PORTLAND, ME. — The Cumberland County Power & Light Company of Portland is securing the right of way for a transmission line from Hiram Falls to West Buxtom.

NASHUA, N. H.—The Board of Aldermen has authorized the Mayor and Lighting Committee to sign a contract with the Nashua Light, Heat & Power Company, for lighting the streets of the city, exclusive of the ornamental lighting system, for a period of seven years. Under the terms of the new contract the arc lamps now in use, of which there are 215, will be replaced with new lamps. Under the new contract 140 additional lamps will be installed.

BOSTON, MASS.—The Edison Electric Illuminating Company of Boston, it is reported, is contemplating the construction of a new power station near the present L Street station. The plans for the initial installation provide for a 30,000-kva., 14,000-volt General Electric turbo-generator, 1800 r.p.m., four 1230-hp. Babcock & Wilcox cross-drum boilers, designed for 350 lb. working pressure.

BOSTON, MASS. — The Metropolitan Water and Sewerage Board contemplates the erection of a transmission line (15.5 miles long) from the power plant at the Wachusett dam to connect this plant with another generating station at the Ludbury dam, which is nearing completion. It is proposed to construct a two-circuit underground cable line 700 ft. from the Wachusett station and a single-circuit overhead line the remainder of the distance. The cost of the work is estimated at $60,000.

FITCHBURG, MASS.—The City Council is considering the question of having all wires on Main Street placed underground.

MANCHESTER, MASS.—Plans are being considered for extensions to the ornamental lighting system on Main Street. The system may be extended to other business streets.

NEWBURYPORT, MASS.—Negotiations are under way between the City Council and the Newburyport Gas & Electric Company for renewal of the street-lighting contract. The installation of a new street-lighting system is also under consideration.

NORTON, MASS.—The Norton Power & Electric Company has applied to the State Board of Gas and Electric Light Commissioners for authority to issue $8,000 additional capital stock, the proceeds to be used to purchase the property and franchises of the Norton Electric Light & Power Company.

PEABODY, MASS.—The installation of an ornamental lighting-system in Peabody is under consideration.

PITTSFIELD, MASS.—The City Council has adopted the recommendation of the committee on fuel and street lights for the installation of 37 additional flaming arc lamps in the ornamental lighting district and also 16 new arc lamps and 45 incandescent lamps in other sections of the city. The Pittsfield Electric Company has the contract for street-lighting.

SPRINGFIELD, MASS.—The United Electric Light Company has awarded the contracts for construction of new power plant as follows: Buildings to A. E. Stephens Company of Springfield; structural steel work to Lewis F. Shoemaker & Company, 45 Broadway, New York, N. Y., and George W. Van Vranken of Schenectady, N. Y., for concrete piling work. The Westinghouse Electric & Manufacturing Company of Pittsburgh, Pa., has the contract for new turbines. The cost of entire plant is estimated at $750,000.

THOMPSONVILLE, CONN.—Plans are being considered for the installation of an ornamental lighting system on Main Street. The Northern Connecticut Light & Power Company has submitted a proposal offering to install the lamps, the cost of which is estimated at $2,800, of which the company would contribute $1,500. It is proposed to use ornamental standards carrying three-lamp clusters.

Middle Atlantic

BATAVIA, N. Y.—Plans are being prepared for filtration plant and installation of new electrical machinery at the municipal pumping station.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

EAST SYRACUSE, N. Y.—The Board of Trustees has awarded the Syracuse Lighting Company a contract for installing a new street-lighting system in East Syracuse. The contract is for a period of five years and provides for 55 nitrogen-filled lamps of 250 cp., 44 lamps of 100 cp. and 32 lamps of 40 cp.

LANCASTER, N. Y.—The Depew & Lancaster Light, Power & Conduit Company of Lancaster has applied to the Public Service Commission for approval of its franchise to furnish electricity in the town of Elma, which includes the villages of Springbrook, Elma Center, Blossom, East Elma and Jamieson Road.

NEW YORK, N. Y.—Bids will be received by Robert Adamson, fire commissioner, eleventh floor, Municipal Building, New York, until June 26 for furnishing, assembling and delivering 110 feeder-post terminal boxes. Blank forms and further information may be obtained at the above office.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, Park Avenue and Fifty-ninth Street, New York, N. Y., until June 26, for additions, alterations and repairs to the electric equipment in Public Schools 25, 39, 71, 75, 119, and High School of Commerce, borough of Manhattan. A separate proposal to be submitted for each school. Blank forms, plans and specifications may be obtained or seen at the office of the superintendent.

OSWEGO, N. Y.—The City Council is considering calling a special election to submit to the voters the proposal to issue $350,000 in bonds for the construction of a 7500-hp. hydroelectric plant on the Oswego River in accordance with plans prepared by John A. Bensel, consulting engineer, 111 Broadway, New York, N. Y.

PERRY, N. Y.—The Perry Electric Company has purchased the property of the old Iroquois Salt Company in Perry. The two buildings on the site will be remodeled and used as a central power plant to supply electricity in Perry, Warsaw, Castile, Silver Springs and Gainesville. A new boiler house will be erected during the summer.

RANSOMVILLE, N. Y.—The Lewiston & Lake Ontario Shore Power Company of Lewiston is erecting an electric transmission line into Ransomville to supply electrical service here.

SANDY CREEK, N. Y.—A special election will soon be held in the village of Sandy Creek and Laconia to vote on the proposal to utilize Niagara power for street-lighting. The company has offered to supply five 250-cp. lamps and 21 lamps of 80 cp. with all-night service at $700 per year for each village.

SEWARD, N. Y.—The Public Service Commission has approved the transfer of a franchise for an electric-light plant in Seward from George Wishart to the Seward Electric Lighting & Power Company and approves the exercise of a franchise by this company. Lighting districts have been established in Seward and Hyndsville. The company has a contract for street-lighting in Seward.

ALLENTOWN, PA.—The Lehigh Valley Transit Company of Allentown contemplates improvements to its system involving an expenditure of $1,000,000 a year for the next five years. The Philadelphia division is to be double-tracked from Allentown to Sixteenth and Market Streets. It is also proposed to build a railway from Bethlehem to Cooperstown or Quakertown.

CHESTER, PA.—The Beacon Light Company of Chester has acquired a tract of 22 acres on the river front on which it will erect a new power plant to cost about $100,000.

FRANKLIN, PA.—The French Creek Township Power Company and the Sandusky Creek Township Power Company, recently incorporated with a capital stock of $5,000 each, to operate in the townships named, will maintain offices in this city.

GREENVILLE, PA.—The Mercer County Light, Heat & Power Company, it is reported, has awarded a contract to the Hanscom Construction Company for the construction of a new power plant in Greenville. The equipment will include two 500-hp. boilers, three turbine engines and three generators of 250, 500 and 750 kw. respectively. Haxen & Crosby are electrical engineers.

HAZLETON, PA.—The Rosell Silk Company, it is reported, will abandon its steam plant and operate its mill by electricity. All machinery in the new addition, to be erected, will be equipped for electrical operation.

LANSDALE, PA.—The Council has awarded a contract to the General Electric Company of Schenectady, N. Y., for a turbine, to cost $12,850. Plans have been prepared for other additions to the equipment at the municipal electric-light plant.

OLD FORGE, PA.—The contract for equipping the collieries of the Jermyn Coal Company in Old Forge for electrical operation has been awarded to the Hartman Electric Company of Scranton. The cost of the work is estimated at about $100,000. Electricity for operating the mines will be supplied by the Scranton Electric Company, which will erect a transmission line to the mine. H. F. Hartman of the Hartman Electric Company has charge of the work.

TITUSVILLE, PA.—The Pennsylvania Railroad Company has installed a large gravel and sand, power screen and washer in a large gravel deposit, about 3 miles from Titusville. This development is to be operated by electricity furnished by the Titusville Light & Power Company.

TITUSVILLE, PA.—The Titusville Forge Company, branch of Bethlehem Steel Company, is building a new power plant to operate its works here. The equipment will include a 750-kw. turbo-generator and complete power installation. Electricity for operating the plant at present is obtained from the Titusville Light & Power Company.

TREVERTON, PA.—Steps have been taken by the Board of Trade and property owners for the installation of a street-lighting system in Treverton.

BRIDGETON, N. J.—The tank factory, power plant, machine shop and mixing building of the glass factory of Parker Brothers were recently destroyed by fire, causing a loss of about $15,000.

BRIDGETON, N. J.—Work has begun on construction of a transmission line to connect the lines of the Bridgeton Electric Company and the Electric Company of New Jersey. The new line will be 18 miles, running from Bridgeton to Woodston via Deerfield, Shirley and Pittsgrove, and will supply electricity to residents along the lines as well as to the cities of Salem, Glassboro, Pitman, Woodbury, Woodstown and Mullica Hill.

BUTLER, N. J.—The Council is considering the extension of the municipal electric-lighting system to Riverdale and vicinity.

MADISON, N. J.—The Borough Council has adopted a resolution providing for the installation of a municipal underground system for the city wires.

PENNSVILLE, N. J.—Plans have been prepared by the Salem-Pennsgrove Traction Company for the construction of a new brick and concrete power house and car barns. Stern & Silverman are engineers.

PORT READING, N. J.—The Port Reading Company is reported to have awarded the contract for construction of a steam and electrically-controlled car-dumping machine and appurtenances at its yards in Port Reading to the McMyler Interstate Company of Cleveland, Ohio, at $159,570. The work includes a 100-ton car dumper, 600-hp. steam power plant and vessel-hauling machine.

UNION, N. J.—The Council has awarded the contract for installation of fire-alarm and police-alarm system to the Central Station Equipment Company, 114 Liberty Street, New York, N. Y., at $22,989.

VINELAND, N. J.—Work has begun on extension to the municipal electric-light plant, which will involve an expenditure of about $40,000.

FAIRMONT, W. VA.—The Monongahela Valley Traction Company of Fairmont has contracted with the Baltimore & Ohio Railroad Company to supply electricity for lighting its local yards, stations and houses. The power plant of the railroad company will be closed down.

WASHINGTON, D. C.—Bids will be received by Edward Canfield, Jr., captain quartermaster corps, Washington, D. C., until July 6, for construction of nurses' home and hydrotherapeutic ward at Soldiers' Home. Hot water heating and lighting in both buildings from central plants. The cost of the nurses' home is estimated at $60,000, and the hydrotherapeutic ward, at $75,000. Plans and specifications are on file at depot quartermaster's offices in New York, N. Y., and Philadelphia, Pa., and at the office of Captain Canfield. Hugh N. McAuley, Woodward Building, Washington, D. C., is architect.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Portsmouth, N. H., Schedule 9803—two gasoline engines for 40-ft. motor boats. Boston, Mass., Schedule 9785—one switching locomotive complete. Various, Schedule 9793—Eighteen motor-driven sewing machines. Annapolis, Md., Schedule 9786—miscellaneous services and installation of overhead track and trolley equipment. Mare Island, Cal. Schedule 9798—three ½-kw. motor-generators. Brooklyn, N. Y., Schedule 9790—twenty radio transmitting sets. Norfolk, Va., Schedule 9796—four turbo-generating sets. Philadelphia, Pa., Schedule 9793—twenty portable ventilating sets; Schedule 9805—miscellaneous tool tungsten steel. Newport, R. I., Schedule 9791—900 lb. 30-in. by 60-in. sheet brass, 775 lb. annealed sheet copper. Philadelphia, Pa., Washington, D. C., Schedule 9805—miscellaneous carbon tool steel. Charleston, S. C., Schedule 9801—one five-ton electric hoist jib crane. Applications for proposals should designate the schedule desired by number.

WASHINGTON, D. C.—Foreign trade opportunities are announced by the Bureau of Commerce reports as follows: No. 21,525—The Bureau is informed that a firm in the United States has received a request for immediate quotations on 30 engines of 550 hp. each, suitable for submarines. These engines are intended for shipment to a neutral country and should be of the Diesel type and oil-burning. No. 21,528—A promotor in the Far East, having in view several irrigation projects, writes an American consular officer that he wishes to receive catalogs and price list of pumps and pumping machinery, especially centrifugal pumps capable of raising 2000 cubic meters of water 9 meters high per hour. No. 21,541—A man from South America, who is now in the United States, is in the market for dynamos, lamps and all kinds of electrical equipment to be used by municipalities. He is also interested in mining machinery for developing gold mines and desires to secure the general agency for firms in hardware and machinery lines. No. 21,545—An American consular officer in Argentina reports that a firm in his district is desirous of receiving catalogs, quotations and agency offers from American manufacturers of excavating machinery, centrifugal and diaphragm pumps for drainage, centrifugal and air-pressure pumps for irrigation, stump-pulling machinery, automobiles, etc. Correspondence may be in English. No. 21,553—A firm in Russia wishes to receive catalogs and quotations from American manufacturers of dynamos and electric motors for oil-well drilling. Further information may be obtained on application to the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., or its branch offices.

North Central

CADILLAC, MICH.—B. E. Parks & Son, engineers, are preparing plans for a power plant for the Cadillac Machine Company at Cadillac.

GRAND HAVEN, MICH.—Plans are being prepared by B. E. Parks & Son, engineers, for increasing the output of the power plant of the Eagle-Ottawa Leather Company of Chicago, Ill., in Grand Haven.

HASTINGS, MICH.—The installation of an ornamental lighting system in the business district, to cost $1,500, is under consideration. The Thornapple Gas & Electric Company supplies electrical service in Hastings.

MENOMINEE, MICH.—Bids will be received at the office of H. H. Blunden, secretary of board of public works, Menominee, until June 29 for improvements to waterworks system, separate bids to be submitted as follows: (1) For furnishing construction of filtration plant, except filter equipment; (2) furnishing and installing complete equipment for four 750,000-gal. mechanical filter units; (3) furnishing and installing one 1,000,000-gal. and one 2,000,000-gal. turbine-driven low service pumps; (4) alternate bids for furnishing and installing a 75-kw. generator and one 1,000,000-gal. and one 2,000,000-gal. motor-driven low service pumps. Plans and specifications are on file in the office of the secretary of board, Menominee, and at the office of Burns & McDonnell, engineers, Inter-State Building, Kansas City, Mo. Copies may be obtained from the engineers upon deposit of $10.

SAULT STE. MARIE, MICH.—The final contract for the completion of repairs to the power house of the Michigan Northern Power Company has been awarded to the Foundation Company of New York, N. Y. All work is to be completed by Nov. 1.

THREE RIVERS, MICH.—The contract for the construction of municipal power plant, it is reported, has been awarded to the Benjamin Douglas Company of Ann Arbor.

WHITEHALL, MICH.—Plans are being prepared by B. E. Parks & Son, engineers, for rebuilding the power plant of the Eagle-Ottawa Leather Company of Chicago, Ill., at Whitehall.

CINCINNATI, OHIO.—Estimates are being prepared by City Service Director Hornberger of the cost of installing an ornamental lighting system in the central part of the city, covering virtually all the downtown business section.

LONDON, OHIO.—The City Council is considering the question of making extensive improvements to the municipal electric-light plant in order to enable it to meet the increasing demands for electrical service.

LORAIN, OHIO—The National Tube Company, which is erecting a battery of by-product coke ovens for the production of coke for the blast furnaces, has announced that a new power house will be built and coal gas will be used to furnish power for the plant.

SALEM, OHIO.—The Public Utilities Commission has granted the Salem Lighting Company (a new corporation) permission to take over and consolidate the Salem Light, Heat & Power Company and the Columbiana Electric Company. The company was also authorized to issue $150,000 in capital stock and $150,000 in bonds to provide funds to carry out the project.

HAZARD, KY.—Final plans and specifications have been completed for the proposed steam-driven electric generating plant for the Kentucky River Power Company in Hazard, to cost about $200,000. Bids for building (85 ft. by 100 ft.) are now being received through H. W. Saunders, Welch, W. Va. All machinery, except conveyor, it is understood, has been purchased. R. L. Cornell is general manager and engineer.

LOUISVILLE, KY.—Limited repairs will be made to the light and heating plant located at the county jail, $3,000 having been appropriated by the Fiscal Court. A new plant, it is stated, will be necessary next year. Brinton B. Davis is county architect.

BLUE ISLAND, ILL.—A joint petition is being made by the Public Service Company of Northern Illinois and the Commonwealth Edison Company of Chicago to the Public Utilities Commission for authority to build an addition to the Blue Island power station of the former company increasing the output by 12,500 kw. The Commonwealth Edison Company will build the station and install the equipment, while it will be operated by the Public Service Company of Northern Illinois. The Commonwealth Edison Company will take the additional output of the plant.

GALESBURG, ILL.—The Galesburg Railway, Lighting & Power Company has submitted a proposal to the City Council offering to furnish energy for the municipal electric plant and water-works system.

JERSEYVILLE, ILL.—Bids will be received by Will Hall, city clerk, Jerseyville, until July 10, for an ornamental lighting system (continuance of seven blocks). For details see proposal columns.

JOLIET, ILL.—Bids will be received by the Canal Commissioners at the office of the Governor of the State of Illinois at Springfield until July 17 (an extension of date from June 15) for proposals for water power lease at Dam No. 1, Joliet, Ill. Specifications, plans, forms of lease and forms of proposal and bond may be obtained upon deposit of $100 at the office of the Canal Commissioners at Lockport, Ill. E. S. Morahn of Lockport is Secretary of Commission.

LEROY, ILL.—The city of Leroy is contemplating the installation of a municipal electric-light plant. Electrical service is now supplied by a trunk line from the plant of the Bloomington & Normal Railway & Light Company at Bloomington.

PEORIA, ILL.—The Public Utility Commission has approved the contract between the city of Peoria and the Central Illinois Light Company for supplying electricity for lighting the city of Peoria for a period of 15 years.

MILWAUKEE, WIS.—The Wisconsin Power, Light & Heat Company of Milwaukee has applied to the Wisconsin Railroad Commission for permission to issue $2,497,000 in bonds and $676,400 in capital stock, the proceeds to be used to purchase and consolidate a group of gas and electric properties operating in the central portion of the State, including the city of Portage, and to construct a 15,000-kw. steam generating plant in that city.

RACINE, WIS.—Preparations are being made for the installation of an ornamental lighting system on State Street.

WAUWATOSA, WIS.—The City Council has accepted the proposal of the Milwaukee Light, Heat & Power Company for lighting the streets of the city. The new contract provides for an increase of 66 lamps and calls for an initial installation of 220 lamps of 60 cp. and eight 250-cp. Mazda lamps, all to be equipped with band refractors.

ELGIN, MINN.—A franchise has been granted to J. A. Baker and W. H. Adams of Rochester, Minn., for the installation of an electric-light plant in Elgin.

GREEN ISLE, MINN.—The Village Council has granted T. Bean a franchise to construct and operate an electric-light plant in Green Isle.

COIN, IOWA—The property of the Coin Electric Light & Power Company has been purchased by the Continental Gas & Electric Corporation, Cuyahoga Building, Cleveland, Ohio, which owns and operates several plants in this vicinity.

LAURENS, IOWA—An election will soon be held to submit to the voters the proposal to issue $5,000 in bonds for the installation of an electric-lighting system.

SCHLESWIG, IOWA—An election will soon be held to vote on the proposal to issue $5,000 in bonds for the installation of an electric-lighting system.

WILLIAMS, IOWA.—The local electric-light plant, owned by F. R. Payne, has been purchased by the Iowa Falls (Iowa) Electric Company, which will take over the property Oct. 1.

WORTHINGTON, IOWA.—A special election will be held July 3 to vote on the proposal to grant the Iowa Railway, Light & Power Company of Cedar Rapids a franchise in Worthington. The company, it is reported, recently purchased a franchise in Manchester and has submitted proposals to furnish electricity in Earlville and other towns in Delaware County.

BONNE TERRE, MO.—The St. Joseph Lead Company has filed a petition with the Public Service Commission for permission to sell its electric system in Bonne Terre to the Missouri Public Utilities Company of Cape Girardeau.

BONNE TERRE, MO.—The Light & Development Company of St. Louis has applied to the Public Service Commission for permission to take over the electric system in the St. Joe mining district, owned by the Bonne Terre Farming & Cattle Company, which supplies electrical service in Bonne Terre and Flat River. If the transfer is approved the plant will be enlarged to furnish electrical service to all the surrounding country in which there are several mining districts.

KANSAS CITY, MO—Investigations are being made by the Kansas City Light & Power Company, it is reported, for a site for its proposed new power plant, which will be built within a year or so, at a cost of $2,500,000.

LA MONTE, MO.—The La Monte Light & Power Company, recently incorporated with a capital stock of $6,000, proposes to install an electric plant in La Monte and deal in electrical appliances. R. W. Morrison, W. S. McCall and Harry C. Loehr are interested in the company.

ST. JOSEPH, MO.—The City Council is contemplating submitting to the voters the proposal to issue $745,000 in bonds, of which the proceeds of $85,000 would be used for rebuilding the municipal electric-lighting plant.

ANAMOOSE, N. D.—Plans are being considered by the Anamoosa Electric Company for extensions to its plant. When completed a 24-hr. service will be established. Contracts for generating equipment, it is understood, have been placed. N. J. Walper is president and manager.

LANKIN, N. D.—A special election will soon be called to submit to the voters the proposal to issue bonds for the installation of a municipal electric-light plant.

NECHE, N. D.—The installation of an electric-light plant in Neche is under consideration. Alex. Rabowski is interested in the project.

PETERSBURG, N. D.—The Petersburg Electric Company, recently organized, proposes to install and operate an electric-light plant here. A. R. Swendseid and others are interested.

ROSCOE, S. D.—Contracts have been closed with the Power Accumulating Company of Dawson for the construction of a municipal electric-light plant. The cost is estimated at $6,500.

HAVELOCK, NEB.—Bids will be received by the Board of Education of Havelock until June 30, for construction of high school building, to cost about $50,000. Separate bids to be submitted on electric wiring, steam heating and plumbing.

SYRACUSE, NEB.—Contracts have been awarded by the village of Syracuse for equipment for the proposed municipal electric-light plant as follows: For material for line construction to the Electrical Appliance Company of Chicago, Ill., at $3,384; pole construction and electrical work, poles and switchboard to the Alamo Engine & Supply Company of Omaha, Neb., at $3,430; generator and exciter to the Columbian Electrical Company of St. Joseph, Mo., $645; for street-lighting equipment, transformers and lighting arresters, to the McGraw Company of Omaha, for $890.

WINNEBAGO, NEB.—Bonds to the amount of $10,000 have been voted for improvements to the municipal electric-light plant and water-works system.

ALMENA, KAN.—Plans, it is reported, are being prepared to rebuild the local electric-light plant, recently destroyed by fire.

BELPRE, KAN.—An election will be held June 26 to submit to the voters the proposal to issue $10,000 in bonds for the installation of an electric-light system in Belpre and the erection of an electric transmission line to Lewis.

HESSTON, KAN.—Plans are being considered by the Commercial Club to secure an electric-lighting system for Hesston.

JENNINGS, KAN.—The city of Jennings is considering the installation of a municipal electric-light plant and water-works system.

NEWTON, KAN.—Arrangements, it is reported, have practically been completed by the Kansas Gas & Electric Company to extend a high-tension electric transmission line to Hesston and Moundridge.

PALCO, KAN.—Plans are being considered for the installation of an electric-lighting system in Palco, to cost from $10,000 to $15,000. Electricity to operate the system will probably be secured from Plainville.

WILLOWDALE, KAN.—Plans are being considered by Weiser & Albers to install electric-lighting and ice plants in Willowdale.

Southern States

KINSTON, N. C.—The installation of an ornamental lighting system in Kinston is under consideration.

COLUMBIA, S. C.—The Columbia Railway, Gas & Electric Company is contemplating extensions to its transmission system.

ARMUCHEE, GA.—The power plant of the Armuchee Mills, recently destroyed by fire, will be rebuilt as soon as possible. A. W. Watters of New York, N. Y., is chief owner of the mills.

BLUE RIDGE, GA.—Plans are being considered for the construction of an electric railway between Blue Ridge and Copper Hill, Tenn., a distance of about 14 miles. H. P. Mulkey is reported interested in the project.

ST. CLOUD, FLA.—The Central Florida Interurban Railway Company has applied for a charter for the construction of an electric railway from St. Cloud to Sanford, Dunnellon and Tampa, also through Volusia County to a point on the Atlantic Coast, covering a distance of about 300 miles. Carl E. Carlton and William S. Alyea are among the incorporators.

KINGSPORT, TENN.—The Kingsport Power Company, recently organized, is planning to supply electrical service in Kingsport. Edwin G. Woodling and others are interested in the company.

MEMPHIS, TENN.—The installation of a municipal electric-light plant, to cost about $1,500,000, is under consideration by the City Council. F. W. Ballard of Cleveland, Ohio, is consulting engineer.

BIRMINGHAM, ALA.—The Alabama Power Company of Birmingham has engaged Allan R. Gilchrist, who for the past ten years has been city engineer of Montgomery, Ala., as chief engineer of the construction of a dam and hydroelectric plant on the Warrior River. The cost of the work is estimated at $1,000,000.

JASPER, ALA.—The property of the Jasper Water, Light & Power Company has been purchased by the Alabama Power Company of Birmingham. The local plant will be closed down and power will be supplied from the substation at Magella, near Birmingham, and in case of emergency from the steam plant to be built on Baker's Creek.

COLUMBUS, MISS.—Steps have been taken by the Columbus Chamber of Commerce for the installation of an ornamental lighting system in the business district.

FLORA, MISS.—Plans and specifications prepared by Xavier A. Kramer, of Magnolia, engineer, for electric-lighting system have been adopted by the city of Flora.

MAGNOLIA, MISS.—The McComb, Magnolia Light & Railway Company of McComb has purchased the plant of the Magnolia Electric Light Company and is now securing the right-of-way for its suburban electric railway, wich will connect Magnolia, Fernwood, McComb City and Summit.

HEBER SPRINGS, ARK.—In connection with the proposed improvements on the Little Red River, contemplated by the Arkansas Hydro-Electric Development Company, it is proposed to construct two dams, and install two power plants, one of 27,000 kw. and the other 17,000 kw., and to erect a high-tension transmission line to Little Rock and Memphis, 160 miles long. Construction plans not yet completed. Guy A. Watkins is secretary of the company.

MONROE, LA.—The City Council is considering rebuilding the municipal electric-light plant and making improvements to the water-works system. Walter G. Kirkpatrick of Jackson, Miss., is engineer.

ARDMORE, OKLA.—The Pioneer Telephone & Telegraph Company contemplates the construction of a telephone system in Ardmore, to cost about $100,000.

DILL, OKLA.—The installation of an electric-lighting system in Dill is under consideration.

FORGAN, OKLA.—At an election held recently the proposal to issue bonds for the installation of a municipal electric-light plant in Forgan was carried.

McCURTAIN, OKLA.—The city of McCurtain contemplates issuing bonds for the installation of an electric-lighting system.

MILBURN, OKLA.—An election will soon be held to vote on the proposal to issue $9,000 in bonds for the construction of an electric-light plant.

PRAGUE, OKLA.—An election will soon be held to submit to the voters the proposal to lease the municipal electric-light plant and water works system to W. E. Ambrister.

STROUD, OKLA.—Bonds to the amount of $30,000 have been voted, the proceeds to be used for improvements to electric-light plant, water-works and sewer system. The Benham Engineering Company, Colcord Building, Oklahoma City, are engineers.

TULSA, OKLA.—The Tulsa Interurban Railway Company, it is reported, has financed its proposed electric railway between Tulsa and Wagoner, via Broken Arrow, a distance of 37 miles. The plans provide for the construction of an electric power station. H. D. Pattee is promoter of the project.

BALLINGER, TEX.—Preliminary surveys are being made by the Interstate Electric Corporation for the extension of its electric transmission lines from Ballinger to Winters, Rowena and Miles, and for improvements to the local plant, to cost about $100,000.

CORPUS CHRISTI, TEX.—The Corpus Christi Traction Company has started work on construction of an electric railway from Corpus Christi to Ward Island, 12 miles long, and within the next 12 months will begin work on the construction of a railway from Corpus Christi to Bishop, a distance of 15 miles. J. H. Caswell of Corpus Christi is general manager.

DALLAS, TEX.—The city of Dallas has signed a contract with the Jones-Duff Electric Company for rewiring the lighting system on the Oak Cliff Viaduct in Dallas.

EL PASO, TEX.—The city of El Paso contemplates the purchase of a turbine engine for water-works system, to cost about $109,000.

SAN ANTONIO, TEX.—Contracts are being placed by the Houston, Richmond & Western Traction Company for material for the construction of its proposed electric interurban railway between Houston and San Antonio. The contract for electric power station, it is understood, will be awarded soon. E. Kennedy is president.

SAN ANTONIO, TEX.—The National Hydro-Electric & Construction Company, which proposes to build a large hydroelectric plant at Marble Falls, has submitted a proposal to the City Council to supply electricity to the city of San Antonio, to be delivered outside of the city limits 12 months from October, 1916. The company asks for a contract of from 20 to 30 years. It will either sell energy to the city or will seek a franchise on liberal terms.

SNYDER, TEX.—Plans are being considered for extensions to the electric-lighting system.

Pacific States

HADLOCK, WASH.—The Hub Electric Company of Hadlock is erecting an electric distribution system to supply electricity in this district. Substations will be erected in Hadlock and Chimacum. The company is operating a franchise covering thirty-three sections of farm districts and small towns. Energy is purchased from the Olympic Power Company of Port Angeles, Wash. James P. Holman of Hadlock is manager.

SPOKANE, WASH.—The Northwestern Mines Development Company of Spokane, owners of the smelter at Keller, it is reported, contemplate remodeling the plant and converting it into an electro-chemical plant. The cost is estimated at $70,000.

TACOMA, WASH.—Work will begin immediately by the Ranier National Park Company on the installation of a 250-hp. electric plant on Van Trump Creek, which will serve both Paradise Valley and Glacier Camps. The proposed plant will cost between $8,000 and $10,000.

ATOLIA, CAL.—Arrangements are being made to light the streets of the town by electricity. Energy will be secured from the Southern Sierras Power Company, which furnishes power for commercial lighting and for the Atolia Mill.

DUNNIGAN, CAL.—The Northern California Power Company of San Francisco has applied for a franchise to supply electricity in Dunnigan.

FRESNO, CAL.—Extensions in the Fresno district, costing about $75,000, are contemplated by the San Joaquin Light & Power Company. About 65 miles of transmission lines, it is reported, will be erected.

LONG BEACH, CAL.—The City Council has engaged Leeds & Barnard, Central Building, Los Angeles, consulting engineers, to pass on plans prepared by the City Engineer for a combined concrete stepped seawall, sidewalk and ornamental lighting system, an improvement contemplated between Chestnut Place and Golden Avenue.

MERCED, CAL.—At special elections held recently the proposal to establish lighting districts in the unincorporated towns of Atwater, Los Palos and La Grande in Merced County was carried. The Supervisors are now authorized to levy a special tax to provide street-lighting in each of these towns.

OAKDALE, CAL.—The power plant of the Sierra & San Francisco Power Company of San Francisco at the new Strawberry dam was recently destroyed by fire, causing a loss of about $20,000.

BOISE, IDAHO.—The American Smelting & Refining Company is contemplating erecting an electric transmission line from Hailey to the North Star and Triumph mines, recently purchased by the company. It is proposed to equip the machinery in the mines for electrical operation.

HELENA, MONT.—The Helena Light & Railway Company is contemplating extending its electric-light service to Lenox.

HYSHAM, MONT.—Bonds have been voted for the installation of an electric-light plant and water-works system in Hysham.

LEWISTOWN, MONT.—The Montana Power Company contemplates extending its electric transmission lines from Lewistown to Judith Gap. The proposed line will run from Lewistown to Moore, thence to Judith Gap, Harlowton and Twedot.

Canada

ANYOX, B. C.—The Granby Mining & Smelting Company has awarded the contract for the construction of a new power house to the Taylor Engineering Company of Vancouver, B. C.

PRINCE GEORGE, B. C.—Tenders will be received by John A. Turner, City Clerk, Prince George, until July 8, for furnishing power plant equipment. DuCane, Dutchers & Company, Rogers Building, Vancouver, are consulting engineers.

WARWICK, ONT.—The construction of a hydroelectric power plant in Warwick is reported to be under consideration by the Township Council.

Miscellaneous

PANAMA—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until July 7, for staybolt iron, galvanized steel or iron, steel cable, wire, sheet brass, sheet copper, tubing, bronze, cable clips, panel boards, electrical attachments, etc. Blanks and general information relating to this circular (No. 1055) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

1,186,532. Electrical Conduit; C. W. Abbott, Auburn, N. Y. App. filed June 22, 1914. Joint for metal moldings.

1,186,542. Dynamo Electric Machine; J. W. Burleigh, Rowbarton, Taunton, England. App. filed July 9, 1909. Application of commutating poles to parallel limbed horseshoe magnet structure.

1,186,561. Electromagnet; C. T. Evans, Milwaukee, Wis. App. filed Oct. 28, 1913. For operating switches or like purposes.

1,186,563. Automatic Common Battery Telephone Exchange; E. D. Fales, Chicago, Ill. App. filed Sept. 26, 1906. Talking current supplied through connectors without necessity of more than four coils. (Forty-six claims.)

1,186,574. Rail Bond; T. Haulton, Wilkinsburg, Pa. App. filed April 22, 1915. Replaces the two bolts ordinarily used at the rail ends.

1,186,585. Electric Switch; C. J. Klein, Milwaukee, Wis. App. filed Aug. 14, 1912. Quick-make and quick-break key socket.

1,186,586. Electric Switch; C. J. Klein, Milwaukee, Wis. App. filed Aug. 14, 1912. Improved two-button flush switch.

1,186,618. Electric Switch; L. L. Tatum, Milwaukee, Wis. App. filed May 2, 1914. For lighting systems of interurban cars.

1,186,658. Speed Control System for Electric Traction Motors; J. E. Haschke, Chicago, Ill. App. filed June 24, 1912. Varies speed without use of resistance.

1,186,704. Trolley Guard; C. M. Sweberg, Yonkers, N. Y. App. filed June 26, 1915. Arrangement of rotary guard wheels.

1,186,710. Electric Water Heater; S. Trood, New York, N. Y. App. filed March 18, 1912. Liquid will not flow from device until it reaches the predetermined temperature.

Record of Electrical Patents

Notes on United States Patents issued June 13, 1916, prepared by Mitchell & Allyn, 41 Park Row, New York.

1,186,791. Charging System for Electrolytic Lighting Arresters; R. P. Jackson, Edgewood Park, Pa. App. filed July 30, 1914. Normally short-circuited resistor inserted in series circuit.

1,186,804. Equalizing Means for Dynamo Electric Machines; B. G. Lamme, Pittsburgh, Pa. App. filed July 24, 1912. Inductive windings related to the polyphase windings.

1,186,815. Protective Device for Electrical Apparatus; J. E. Mateer, Wilkinsburg, Pa. App. filed July 17, 1912. Provides function of static shield and choke coil.

1,186,817. Semi-Automatic Telephone System; E. A. Mellinger, Chicago, Ill. App. filed May 9, 1913. Calling device automatically connected with idle trunk.

1,186,818. Regulating System for Electric Machines of the Revolving Field Type; F. W. Meyer, Duisburg, Germany. App. filed Oct. 7, 1911. Phase winding arranged so that effective portion may be shifted and convolutions adjusted.

Fig. 1.

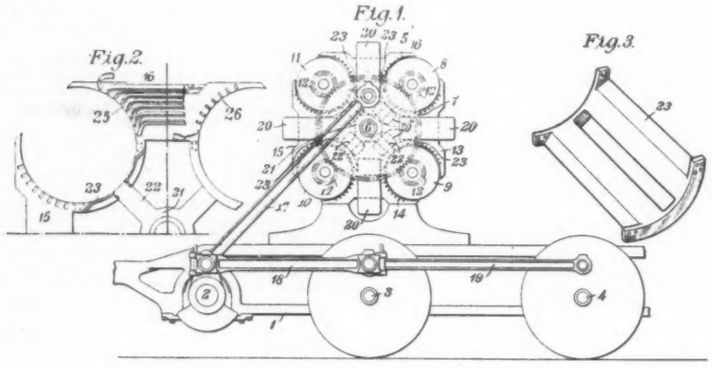


Fig. 2.

Fig. 3.

No. 1,186,755. Electric Locomotive

1,186,724. Car Truck; W. S. Adams, Philadelphia, Pa. App. filed June 18, 1915. For relatively light electric cars.

1,186,734. Canopy Insulation; E. E. Bechtold, Chicago, Ill. App. filed Jan. 25, 1915. Readily applied to the canopy.

1,186,746. Telephone Transmitter; C. L. Chisholm, London, Ontario, Canada. App. filed May 31, 1913. Employs greater amount of resistance material without danger of packing.

1,186,755. Electric Locomotive; J. LeC. Davis, Pittsburgh, Pa. App. filed Aug. 7, 1911. Plurality of relatively small armatures distributed about a central countershaft.

1,186,765. Electrical Measuring Device; C. LeG. Fortescue, Pittsburgh, Pa. App. filed Oct. 31, 1913. Method of measuring maximum value voltage of circuit.

1,186,767. Electrical Measuring Instrument; W. S. Gorton, Baltimore, Md. App. filed May 4, 1915. Measures maximum value of voltage wave irrespective of frequency, etc.

1,186,769. Circuit Closer for Mail Box Alarms; S. F. Gulley, Lawrence, Kan. App. filed June 17, 1915. Mounted in a box and operated by a box lid.

1,186,770. Circuit Interrupter; F. D. Hallock, Pittsburgh, Pa. App. filed Dec. 26, 1911. No-voltage release.

1,186,772. Electric Indicator for Mail Boxes; M. Hammons, Laporte, Ind. App. filed Feb. 20, 1914. Special annunciator system.

1,186,773. Electric Self-Feeding Soldering Iron; H. H. Harris, Oconto, Wis. App. filed April 28, 1915. Receives a stick of solder.

1,186,819. System of Distribution; F. W. Meyer, Wilkinsburg, Pa. App. filed Jan. 11, 1913. Secondary winding of induction motor connected to supply circuit through auxiliary machine.

1,186,823. Measured-Service Tlelphone System; F. Newforth, Jr., Liverpool, England. App. filed Aug. 25, 1913. Meter operated over the release trunk.

1,186,851. Synchronizer; M. L. Severy, Arlington Heights, Mass. App. filed April 10, 1911. Applicable to rotating make-and-break devices for production of electric pulsations.

1,186,852. Switch Portable Lamp; G. B. Slocum, Waterbury, Conn. App. filed Aug. 3, 1914. Pocket flashlight switch construction.

1,186,857. High-Tension Strain Insulator; L. Steinberger, Brooklyn, N. Y. App. filed Feb. 10, 1912. Multiple-unit insulator construction.

1,186,859. Battery Box; R. J. Stephenson, Auburn, N. Y. App. filed June 8, 1914. Has an insulating compartment for each dry cell.

1,186,862. Insulator; O. P. Swartz, Mount Pleasant, Pa. App. filed Sept. 9, 1915. Prevents grounding by moisture.

1,186,864. Automatic Cut-In for Telephone Reinforcing Device; E. E. Trafton, Portland, Me. App. filed May 7, 1912. Applicable to ordinary desk set.

1,186,886. Electric Clock; J. Cook, Allendale, N. J. App. filed Feb. 2, 1915. Rewinding energy applied at intervals of between one and two minutes.

1,186,890. Electric Regulation; J. L. Creveling, New York, N. Y. App. filed Sept. 16, 1910. Storage-battery system.

1,186,898. Electrolytic Apparatus; W. E. Greenawalt, Denver, Col. App. filed Aug. 28, 1913. Realizes high cathode and anode efficiencies.

1,186,901. Ground Clamp; W. H. Higgins, Philadelphia, Pa. App. filed June 17, 1913. Made of simple strip metal.

1,186,908. Automatic Selector Switch; C. A. W. Hultman, Stockholm, Sweden. App. filed July 9, 1914. Simple construction for telephone use.

1,186,921. Method for Synthetic Production of Cyanogen Compounds; A. R. Lindblad, Ludvika, Sweden. App. filed Nov. 18, 1914. Free spaces are left between material and brick work of furnace where electrodes enter.

1,186,930. Electrical Switch Mechanism; W. J. Newton, Lynbrook, N. Y. App. filed April 5, 1915. Push-button construction.

1,186,934. Temperature Indicating Mechanism; H. Y. Norwood, Rochester, N. Y. App. filed Feb. 3, 1915. Especially applicable to refrigerator cars.

1,186,937. Electrolytic Apparatus; J. Pfleger and F. Ott, Frankfort-on-the-Main, Germany. App. filed Oct. 2, 1913. Protected from chlorine.

1,186,941. Electrically-Operated Typewriter; P. C. Rawls, Des Moines, Iowa. App. filed Feb. 3, 1911. Simple construction with selective magnets.

1,186,953. Sign Receptacle; J. S. Stewart, New York, N. Y. App. filed July 19, 1910. Simple screw means for securing in place.

1,186,959. Circuit Breaker Relay; A. H. Weiss, Chicago, Ill. App. filed Nov. 8, 1913. Operated by abnormal current flow in automatic circuits.

1,186,986. Incandescent Lamp; G. F. Heustis, Malden, Mass. App. filed June 22, 1914. Has means for completing circuit when filament breaks.

1,186,993. Apparatus for Producing Ultra-Violet Radiation; F. G. Keyes, Boston, Mass. App. filed July 1, 1913. Two chambers of gas at different pressures.

1,187,010. Safety Plug; M. R. Rodrigues, Brooklyn, N. Y. App. filed Nov. 17, 1913. Interchangeable switch plug for electrically heated appliances.

1,187,035. Telegraphy; A. H. and R. W. Bumstead, Townsend and Brookline, Mass. App. filed May 1, 1911. Single wire and requires no skilled operator.

1,187,053. Lock Socket for Electric Light Bulbs; C. F. Dwyer, Ashland, W. Va. App. filed Sept. 15, 1914. Prevents unauthorized removal of lamp.

1,187,103. Casing for Portable Electric Flashlights; C. J. Sagebrecht, Brooklyn, N. Y. App. filed Dec. 18, 1915. Conductor for completing circuit is molded in casing.

1,187,148. Pressure Indicating and Controlling Means; M. R. Hutchison, Summit, N. J. App. filed March 16, 1911. For indicating when storage battery has been fully charged.

1,187,166. Cored Carbon with Arc Extinguishing Plug; W. R. Mott, Lakewood, Ohio. App. filed Dec. 26, 1911. Plug of arc extinguishing material in end of channel in carbon.

1,187,180. Means for Improving the Power Factor of Induction Machines; A. Scherbius, Baden, Switzerland. App. filed Dec. 12, 1911. Phase compensation.

1,187,301. Lamp Grip; G. W. Goodridge, Bridgeport, Conn. App. filed Aug. 10, 1914. For locking lamp inserted in socket.

1,187,303. Electrical Switch; C. O. Graham, Seattle, Wash. App. filed Aug. 16, 1912. Oil switch operated by pilot switch.

1,187,315. Electric Flasher; G. W. Henry, Jr., Philadelphia, Pa. App. filed Feb. 28, 1914. For electric signs and pictures.

1,187,330. Device for Locking Electric Lamp Bulbs in Receptacles; F. Jordan, San Francisco, Cal. App. filed May 14, 1915. Key-operated lock.

1,187,372. Electric Brake System; O. E. Nilsen, Fargo, N. D. App. filed Sept. 3, 1914. Includes reversible motor.

1,187,404-1,187,410. Electric Welding Systems. D. H. Wilson, Paterson, N. J. Smooth weld by steady current.

14,151 (Reissue). System of Distribution; T. W. Varley, New York, N. Y. App. filed May 8, 1916. Original 1,175,320, dated March 14, 1916. Three-phase, twelve-phase transformation.

Electrical World

New York, June 24, 1916

Volume 67, No. 26 — Pages 1449-1504

Contents

The Testing of Household Appliances. By H. A. Cozzens, Jr. 1460
How the Safety, Efficiency, Economy and Durability of Devices to Be Offered for Sale to Customers Are Investigated by a Large Public Service Organization.

Domestic Water Heating by Electricity versus Gas. By R. L. Webb 1464
Electrical Energy at 1.3 Cents Declared Comparable to Dollar Gas—How Addition of Water Heater in Dwelling Where Electric Range Is Installed May Double Company Income.

To Build Electric Range Business. By J. B. Crawford 1468
Suggestions for the Planning of the Campaign—Winning the Salesmen to the Electric-Cooking Idea—Demonstrations the Best Form of Advertising.

What to Do in Fan Time. By Earl E. Whitehorne ..1465
Figuring Expenses and Profits in Contracting. By O. G. Pack 1466
A Portable Transformer Outfit That Aids in Producing the "Movies." By S. M. Kennedy 1469
Electric Drive in Clay Product Manufacture. By Norman G. Meade 1470
Manifold Uses of Electric Truck in Washington Navy Yard 1472
Adding Hours to Summer Days for Outdoor Recreations 1462

Editorials

Welcome—Engineers 1449
What the Public Thinks of Us 1449
Knowing the Cost of Doing Business 1449
Opportunities for the Electric Vehicle 1449
Flood-Lighting for Sports 1450
An Electric Arc Furnace for Laboratory Use ..1451

News of the Week

Merchandising and Public-Policy Topics Discussed by Michigan Section 1452
Western Governors to Discuss Water Power 1452
Tax on Electrical Energy Proposed for Russia ..1452
America's Electrical Week Local Committees Appointed 1452
Convention of New Jersey Contractors 1452
Display of Posters Designed for Electrical Week 1453
The "Biggest Things" in Water-Power Development 1453
Commonwealth Edison Annual Field Day 1453
Automatic Operation of a Small Hydroelectric Plant in North Carolina 1454
Portland Railway & Light Valuation 1455
Decision in Washington Water-Power Case 1456
Progress in International Standardization 1458

News of the Industry

Associated Manufacturers of Electrical Supplies Section 1490

Marketing Electricity

Company Display Used to Pledge Merchants to Electric Sign Campaign 1473
A Map of Prospective Power Customers 1473
St. Louis Company Is Large User of Electrical Advertising 1474
Advertising the Electric Range in Salt Lake City 1474
Flood-Lighting Local Monuments—A Fourth of July Feature at Allentown, Pa 1475
Fair Booth a Profitable Inquiry Producer 1475
The "Movie" Theater as a Central Station Customer 1475
An Original Patriotic Window Display at Oak Park, Ill 1475
Results of Prize Offer for House-Wiring Month Contracts 1476
Saving the Customer Steps 1476
Advertising on a Postcard Bill 1476
Electric Comfort for the Horse 1476

Station and Operating Practice

Reducing Size of Service Wires 1477
How an Apparent Overload Motor Trouble Was Traced to Fuse Block 1477
Construction of Switchboard Cable Trenches 1478
Predetermining Composition of Concrete for Tower Foundations by Trial 1478
Cost of Rewinding Burned-Out Transformer Versus Removing Terminal Blocks for Protection 1479
Method of Varying Lamp Bank Loads on Two-Wire and Three-Phase Circuits 1480
Making Uniform Steam Pressures with Fluctuating Steam Demands 1480

Advance in Technical Theory and Practice 1481
Book Reviews 1484
Men of the Industry 1485
New Apparatus and Appliances 1486
Finance, Commerce and Industry 1495
Corporate and Financial 1498
Record of Electrical Patents 1504

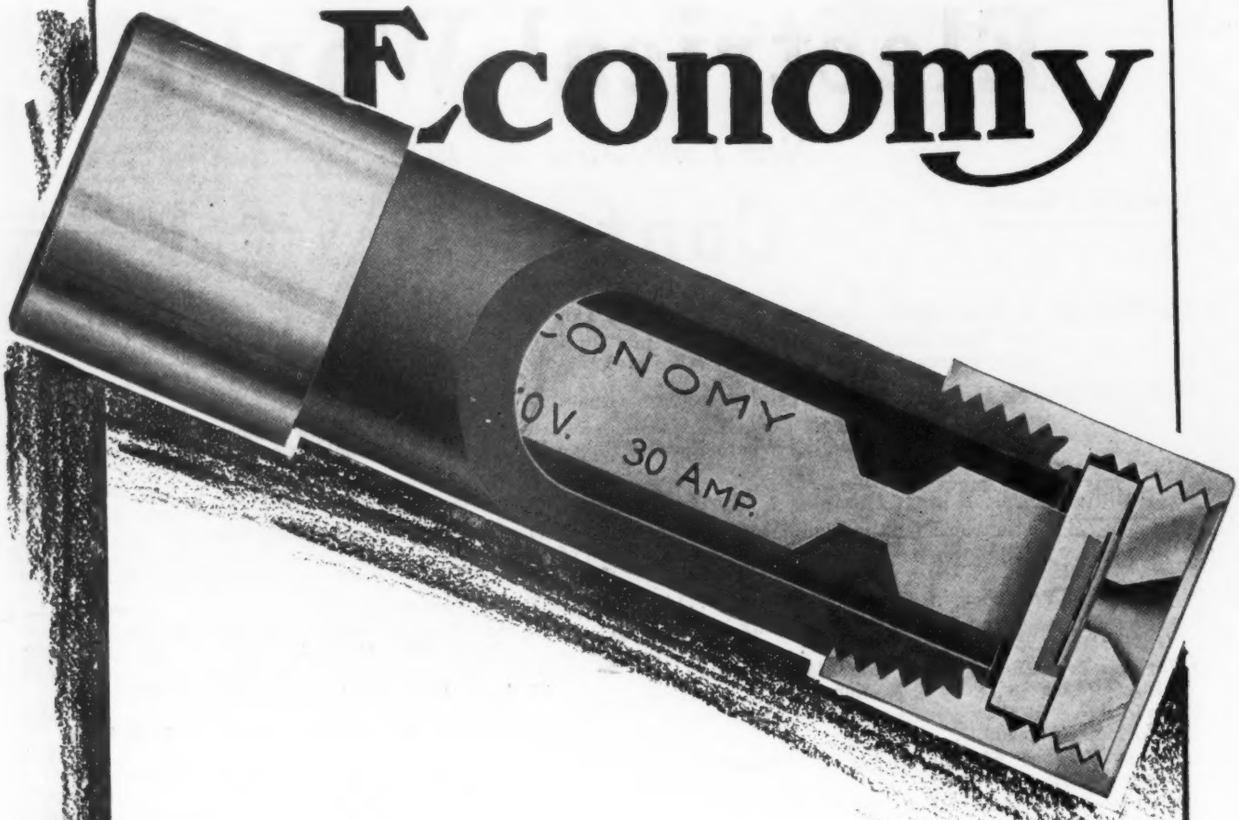
JAMES H. MCGRAW, President. A. E. CLIFFORD, Secretary. J. T. DEMOTT, Treasurer. F. M. FEIKER, Editor.

McGraw Publishing Company, Inc.

CHICAGO, 1570 Old Colony Bldg.
CLEVELAND, Leader-News Bldg.
PHILADELPHIA, Real Estate Trust Bldg.
239 West 39th St., New York City
SAN FRANCISCO, 502 Rialto Bldg.
LONDON, ENG., 10 Norfolk Street, Strand.

COPYRIGHT, 1916, by MCGRAW PUBLISHING COMPANY, Inc. Published Weekly. Entered at N. Y. Post Office as Second Class Mail. United States, Mexico, Cuba, Porto Rico, Hawaii, or the Philippines, $3 per year; Canada, $4.50; elsewhere, $6. Single copy, 10c.
No back volumes for more than one year and no back copies for more than three months.
Circulation of this issue, 19,000 copies.
ELECTRICAL WORLD—MEMBER SOCIETY FOR ELECTRICAL DEVELOPMENT, INC.—"DO IT ELECTRICALLY"

Economy



The service record of Economy Fuses is their greatest asset.

In every branch of industry absolute electrical protection is being afforded. Great industrial plants are contracting for an entire year's supply of fuses, and one consistent customer is the U. S. Government. There are many thousands of satisfied users.

The saving of 80% of annual fuse expense, plus the great convenience and the absolute uniformity of electrical performance, are some of the reasons.

Examine Economy Fuses at your dealers.
Write to us for Catalog No. 19 and free samples.

Economy Fuse & Mfg. Co.
Kinzie and Orleans Streets - - CHICAGO

BAKELITE
Impregnated Transformer

—even when there's a Short in the Transformer

There's little danger of the insulation burning out if the coils are impregnated with

BAKELITE

The transformer will carry heavier current loads—it will stand more abuse—it will safely carry higher accidental voltage. There's small chance for damage from hot spots with Bakelite Coil Impregnation because it dissipates heat from the coils much faster than ordinary compounds and it does not soften and melt as do other impregnating materials.

But ability to withstand heat is not the only quality you get when you use Bakelite. It is chemically inert; it is unaffected by steam, hot oil, solvents, and most chemicals. It has high mechanical and dielectric strength.

You ought to have our booklet on Coil Impregnation

BAKELITE
The Premier Moulded Insulation

GENERAL BAKELITE COMPANY
100 WILLIAM STREET, NEW YORK

55-139

THIS PACKARD PAYS ITS WAY

THE Puget Sound Traction, Power & Light Company, of Seattle, owns a four-ton Packard Chainless Motor Truck which hauls cinders away from the plant. The return from the sale of the cinders to contractors and building supply dealers more than pays the cost of operation and maintenance of the truck.

PACKARD CHAINLESS TRUCKS possess every element necessary for plant and line construction work. They have the speed which takes the repair crew to the break in a hurry. They have the ruggedness which allows for maximum service over a long period of years.

Simplicity of design and complete standardization of working parts save time, labor and money in making repairs.

PACKARD LIGHT SERVICE TRUCKS are rated respectively at 1—1¼ and 1½—1¾ tons. For larger loads there are five sizes of Heavy Service Packards, 2 to 6½ tons' capacity. Power-driven winches, derricks, hoisting and dumping apparatus may be applied as special equipment. *Write Department O for catalog and data on Packard performance in your line.*

PACKARD MOTOR CAR COMPANY, DETROIT

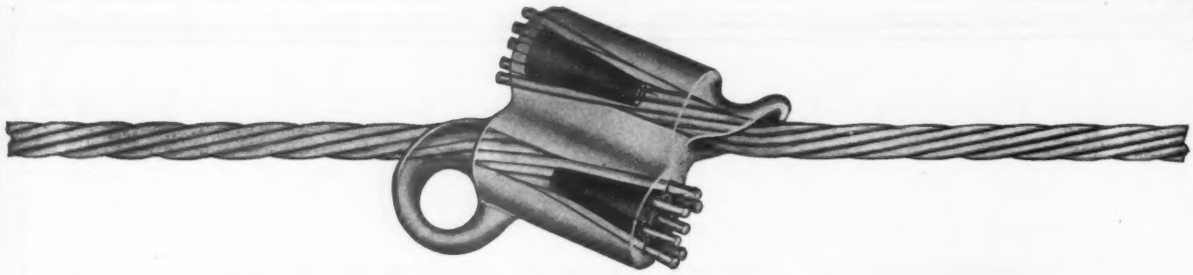
Ask the man who owns one

Packard

CAUTION

The genuine DURADUCT is trade-marked with a black dotted line.

Your jobber has it.
Avoid Substitutes.



Illustrating method of splicing with Twin Clamp. Note that tapered plugs are inserted at opposite ends. Eye in lower side is for purpose of taking up slack. Splice can also be made with two Clevis Clamps as shown in Fig. 5.

A 24 Ton Strain Broke the Cable—

—and it was an **extra high strength, plow steel, nineteen wire strand** cable, at that. At each end was applied a MARCHAND CLAMP. Then the strain was exerted. At 48,200 lbs. every wire of the strand broke—

—but the grip of

MARCHAND CLAMPS

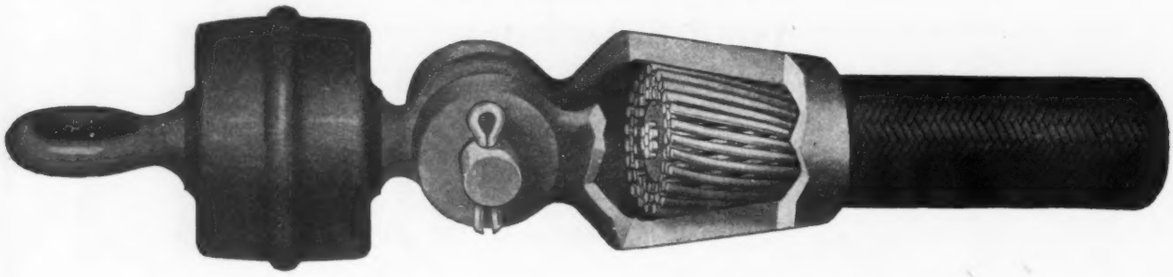
never budged a jot!!

Marchand Clamps are made in several types, some of which are here illustrated—everyone unique in its tremendous holding power, superior convenience, and cable-saving qualities. **Write for data on tests** with full details and prices.

Views showing Pole Clamp in use at top of pole. Note small size hole required through center of pole for guy wire.

Steel City Electric Co.

1207-1219 Columbus Ave. Pittsburgh, Pa.

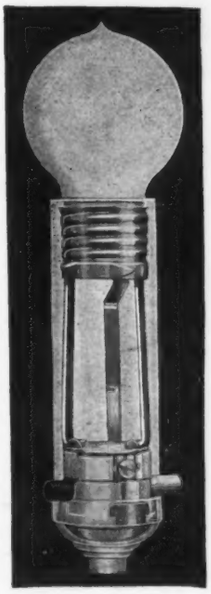


View showing Marchand "Dead-Ending" Clevis Clamp attached to strain insulator and clamping end of 1,000,000 C. M. stranded copper conductor. Note the seven core wires projecting through hole in center of tapered plug and three layers of sheath wires alternately crossing and clamped between tapered plug and wall of socket.

An Electric Candle in One Complete Unit

A New Idea in Socket Construction

Here's an entirely new idea in sockets that eliminates the expense of stocking, handling, and assembling the various parts of the usual candle light fixture.



Phantom view of C-H Candle Length Socket. Note how this single unit socket eliminates the several parts usually necessary in candle light construction. Substantial supports hold the screw shell. The mechanisms of this socket and standard C-H Brass Shell Push Sockets are identical.

The C-H Candle Length Socket is one complete unit ready to install on the fixture as easily and quickly as a standard brass shell socket. The time saved alone in fixture assembly reduces your costs.

C-H Sockets
CANDLE LENGTH TYPE

are made up of uniform parts in our factory and shipped assembled like any other complete socket. The strong mechanical construction insures long service—the screw shell holds the lamp in alignment and the fibre candle locks securely into the cap. It snaps in place just like the brass shell of C-H Push Sockets.

Various styles are made—all 660-Watt capacity. Descriptive folder just printed. Our nearest office will mail you a copy.

C-H Push Socket, Candle Length Type, (Cat No 7516) on single candle light wall bracket.

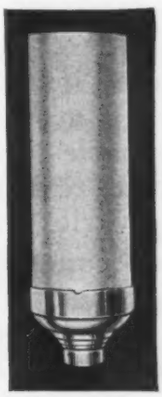
THE CUTLER-HAMMER MFG. CO.
MILWAUKEE, WISCONSIN

New York Chicago Pittsburg Boston
Cleveland Philadelphia Cincinnati San Francisco

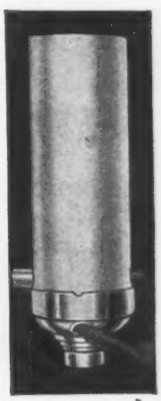
C-H Push Socket, Candle Length Type used on simple candle stick. Inlet for cord in side of cap eliminates interior wiring of this style of portable and makes it possible to assemble a portable of this type quickly.

C-H 7528 Candle Length Socket

C-H 7516 Candle Length Push Socket



C-H 7517 Candle Length Socket without mechanism



C-H 7528 Candle Length Push Socket with side inlet cap

Duncan A. C. Watthour Meter

Model M 2

From among all of the meters so far built, none has ever met the exacting requirements of everyday service as has this latest product of the Duncan Company—the Model M2.

Just think of it! It operates continuously on ½ of 1% of full load; is accurate to within ½ of 1% from 5% to 200% load; varies less than ½ of 1% for 10% change of voltage; varies less than ½ of 1% for 10% change of frequency, and varies less than 1% for power factor of 50%.

The most economical and the most reliable meter investment for the up-to-date central station is the Duncan Model M2. Send for bulletin and prices. A sample for test forwarded at our expense, for the asking.

DUNCAN ELECTRIC MFG. COMPANY

Lafayette, Indiana

Peerless

Evident Quality

In our series of multi-page colored advertisements which have appeared in this publication during the past few months

—you have noted the wide variety of Peerless motor applications.

—you have read the letters of praise for Peerless Motor Service by the makers of the motor driven devices.

Did you also make note of the EVIDENT quality of Peerless Motors?

—Peerless Motors are not only *good* motors but also *good-looking* motors.

One branch of Peerless service is to provide a motor which *harmonizes* with the complete apparatus.

The motor and the apparatus driven, form *a unit.*

Design rather than *assembling* characterize the unit.

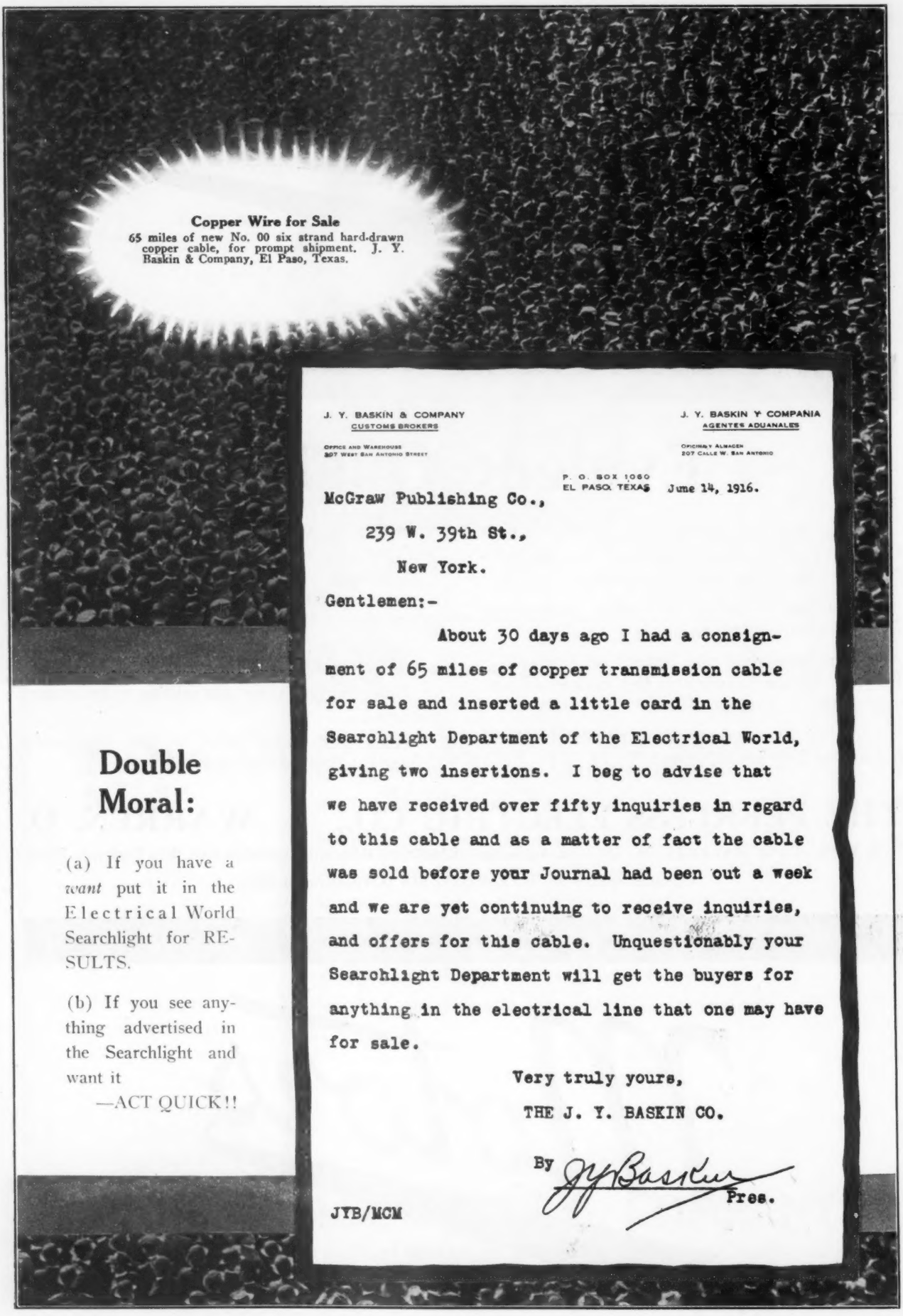
—and that helps sales of the apparatus driven by Peerless Motors.

THE PEERLESS ELECTRIC CO., WARREN, O.

New York—C. O. HALL, 147 W. 35th St. Chicago—Electrical Machinery Sales Co., 836 Webster Bldg.

Philadelphia—M. H. RODDA, 618 Witherspoon Bldg.

Motors


Copper Wire for Sale
65 miles of new No. 00 six strand hard-drawn copper cable, for prompt shipment. J. Y. Baskin & Company, El Paso, Texas.
J. Y. BASKIN & COMPANY
CUSTOMS BROKERS
OFFICE AND WAREHOUSE
207 WEST SAN ANTONIO STREET
J. Y. BASKIN Y COMPANIA
AGENTES ADUANALES
OFICINA Y ALMACEN
207 CALLE W. SAN ANTONIO
P. O. BOX 1060
EL PASO, TEXAS
June 14, 1916.
McGraw Publishing Co.,
239 W. 39th St.,
New York.
Gentlemen:-
About 30 days ago I had a consignment of 65 miles of copper transmission cable for sale and inserted a little card in the Searchlight Department of the Electrical World, giving two insertions. I beg to advise that we have received over fifty inquiries in regard to this cable and as a matter of fact the cable was sold before your Journal had been out a week and we are yet continuing to receive inquiries, and offers for this cable. Unquestionably your Searchlight Department will get the buyers for anything in the electrical line that one may have for sale.
Very truly yours,
THE J. Y. BASKIN CO.
By J. Y. Baskin Pres.
JYB/MCM
Double Moral:
(a) If you have a want put it in the Electrical World Searchlight for RESULTS.
(b) If you see anything advertised in the Searchlight and want it
—ACT QUICK!!

Here is the

Type I Oil Starter

that is preventing properly fused polyphase motors in all kinds of industrial plants from running single phase.

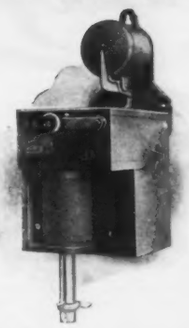
Any capacity up to 30 amperes at 600 volts or less.

Always in stock for immediate shipment.

And next is the

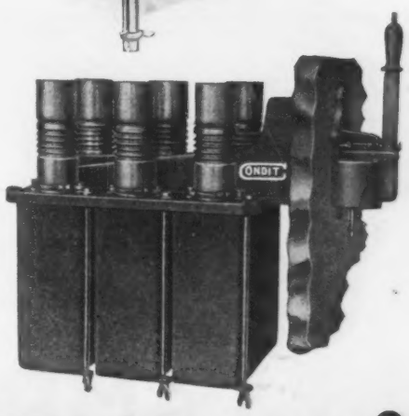
Type ID Oil Circuit Breaker

with overload and no-voltage attachments—the best insurance policy ever issued on the life of any motor.



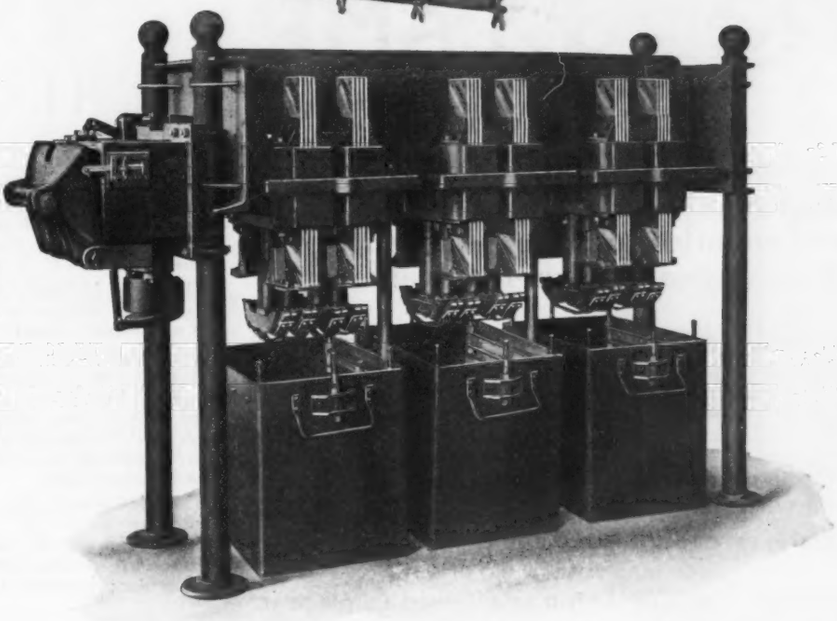
If you have an induction motor taking 50 amperes or less at 600 volts or less, the Type ID is the logical protection for it.

Now we come to the Type D-12, a rugged heavy duty oil switch. Built to withstand the wear and tear of service and to afford real protection all the time.



For circuits where the capacity does not exceed 1200 amperes at 15,000 volts or less.

And last, but not least, the "Big Ben" of all oil switches—the electrically operated Type Y.



Built to carry—easily too—5000 amperes at 3300 volts or less.

If you have a rush installation to make, call upon us, the chances are we have in stock the very switch you need.

Condit Electrical Mfg. Co.

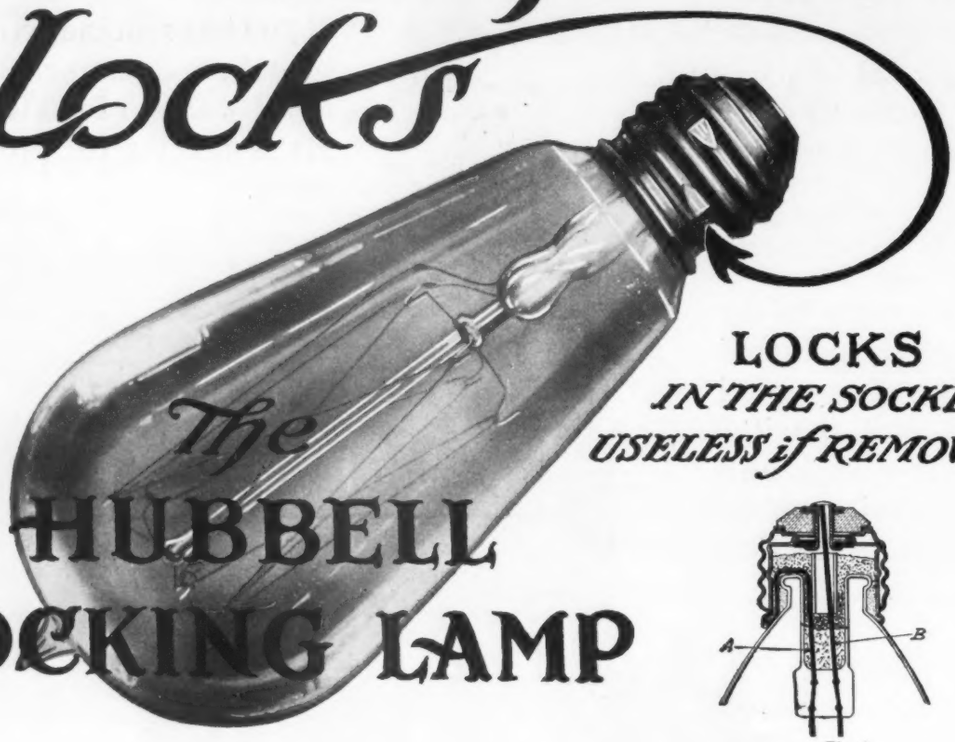
Boston, Mass.

Akron, Flatiron Bldg.
Albany, 401 Dolan Bldg.
Birmingham, Brown-Marx Bldg.
Buffalo, 1205 Electric Bldg.
Charlotte, N. C., Commercial Bank Bldg.
Chicago, 19 South Fifth Ave.
Cincinnati, Union Trust Bldg.
Dallas, 408 South Ervay St.
Denver, 1621 Seventeenth St.
Detroit, 616 Ford Bldg.
Kansas City, Mo., Traders Bldg.
Los Angeles, San Fernando Bldg.
New York, 39 Cortlandt St.
Philadelphia, 929 Chestnut St.
Pittsburgh, 947 Penn Ave.
Portland, Ore., Morgan Bldg.
Richmond, Allison Bldg.
Salt Lake City.
San Francisco, 583 Howard St.
Seattle, 309 First Ave., South
Troy, 332 River St.
Washington, D. C., Conduit Road & Elliott St., N.W.

Northern Electric Company LIMITED

Sole Distributor for the Dominion of Canada, Montreal, Halifax, Toronto, Winnipeg, Regina, Calgary, Edmonton, Vancouver, Victoria.

The Lamp that Locks



The HUBBELL LOCKING LAMP

LOCKS
IN THE SOCKET
USELESS if REMOVED

Fig. 1

For years hotel and theatre managers, office building proprietors, directors of libraries and hospitals and countless other public institutions have sought an unstealable, un-removable lamp.

Up to the present time it has only been necessary to unscrew a lamp in order to attach heating or other devices to the socket or to steal the lamp itself.

The Hubbell Locking Lamp puts an end to this condition and does away with the danger of blown out fuses, misuse of current or unauthorized removal of lamps.

Once the Hubbell Locking Lamp is screwed in place it is there to stay until it is burned out.

The base of this lamp fits any standard Edison socket. It has an outer rotating shell and an inner shell cemented to the lamp. See Figure 1.

Once the Hubbell Locking Lamp is attached, it cannot be removed like an ordinary lamp. It turns and turns, but it doesn't unscrew.

Burned out or broken lamps can be removed by giving a slight downward pull. This action causes the outer shell of the base to engage a reverse ratchet and the lamp may then be unscrewed.

The downward pull breaks the leading-in wire "B." When the lamp is removed the electrical connections are permanently destroyed and the lamp becomes useless.

Let Us Tell You Fully About the Hubbell Locking Lamp

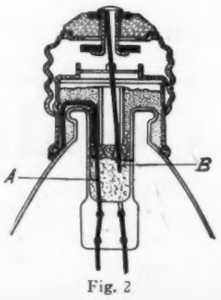


Fig. 2

Harvey Hubbell Inc.
BRIDGEPORT, CONN.

Johns—Manville

COVERS THE CONTINENT

Serves More People in More Ways Than Any Other Institution of Its Kind in the World

in the old days—

IN the old days, power was a matter of throwing cord wood or coal into the fire box—its cost was secondary. But that is a thing of the past. Power costs too much to allow it to go wasted in pulling against poor packing, faulty insulation or bad design.

Now—everything which affects power cost is studied as a specialty and is developed to the top notch of efficiency.

Johns-Manville Service is right in step with this tendency for lowest cost per H. P. hour. Every product, every service is a move in that direction.

If you are in tune with progress, you believe in the idea of Johns-Manville Service—the products are the expression of the idea.

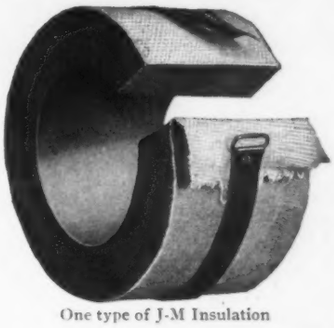
Akron,
Albany
Atlanta
Baltimore
Birmingham
Boston
Buffalo
Chicago
Cincinnati
Cleveland
Columbus
Dallas
Dayton
Denver
Detroit
Duluth
El Paso
Galveston
Havana
Houghton
Houston
Indianapolis
Kansas City
Los Angeles
Louisville
Memphis
Milwaukee
Minneapolis
Nashville
Newark
New Orleans
New York
Omaha
Philadelphia
Pittsburgh
Portland
Rochester
St. Louis
St. Paul
Salt Lake City
San Diego
San Francisco
Seattle
Syracuse
Toledo
Tulsa, Okla.
Washington
Wilkes-Barre
Youngstown

EXECUTIVE OFFICES
296 Madison Avenue
NEW YORK CITY

The Canadian H. W. Johns - Manville Co., Ltd., Toronto, Winnipeg, Montreal, Vancouver. For Great Britain and Continent of Europe: Turners & Manville, Ltd., Hopetoun House, 5 Lloyds Ave., London, E. C.

H. W. JOHNS-MANVILLE CO.

The high cost of fuel and big cost of production argue for good Insulation—J-M Insulation



One type of J-M Insulation

When you dig down into the very roots of fuel waste you find that it is caused by loss of heat units through radiation and convection and conduction all along the system—you are burning up more fuel than necessary.

What we offer you in *J-M Insulations* is the most efficient and practical insulations that we are able to produce. With twenty-one types to choose from, every specific need in service is met.

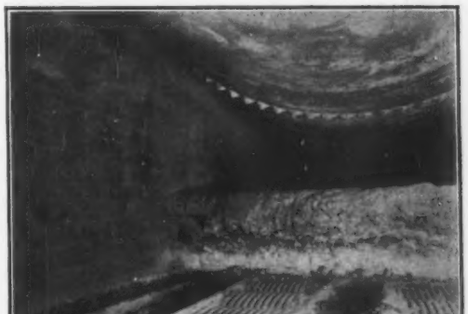
J-M Service, a corps of expert installation men and advisors, will work with you in the selection of the type of insulation best fitted for your use. Get the good work started by writing today.

J-M Fire-Brick Treatment avoids the useless labor of frequent boiler resetting

The principal cause for frequent resetting is the concentration of heat on the exposed surface of fire-brick and where the edges meet. The constant play of the flames soon spawls or else fuses the brick, opens up joints and eats the life out of the whole expensive setting.

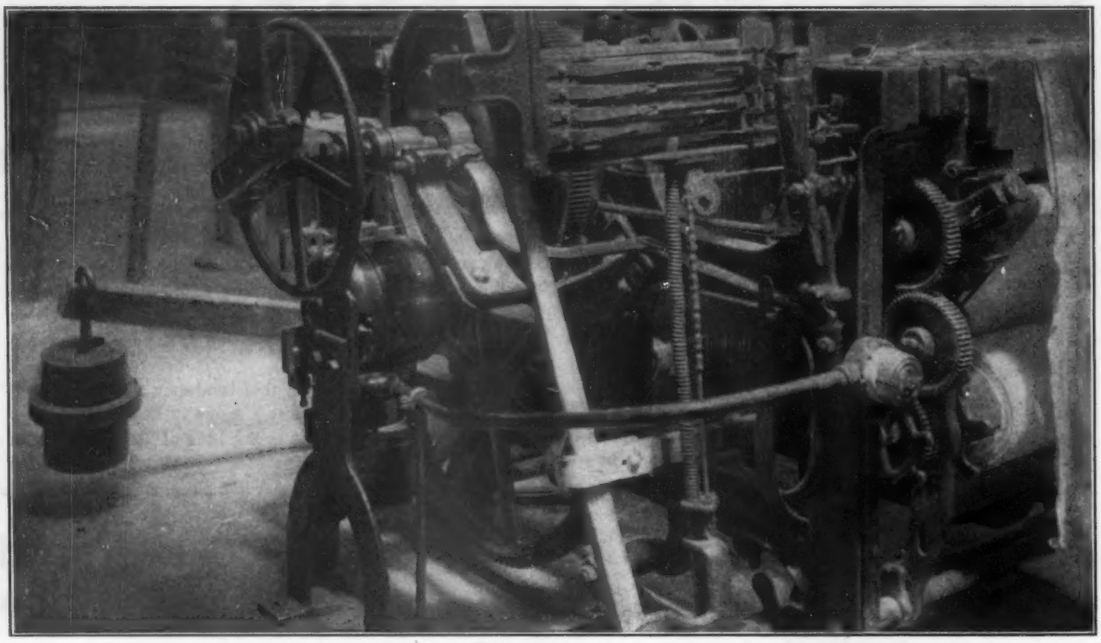
J-M No. 31 High Temperature Cement is used as a mortar between the fire-brick courses and seals them into a solid vitrified wall of cement and brick that will resist any change of temperature to which your boiler may be subjected. It vitrifies at a low furnace temperature and maintains this condition up to 3187 deg. F., its fusing point, which is greatly in excess of your furnace requirements.

When the new setting is made, **No. 32 High Temperature Cement** should be painted over the entire face, filling up all cracks and pores in the brick face, preventing cracking, spawling, gas or air leaks under the most severe furnace heat. Write any branch for Booklet.



Boiler furnace wall set with J-M No. 31 H. T. Cement in boiler-room of Christian Science Publishing Co., Boston. In continual use under stoker conditions for nearly a year and still good for an indefinite period.

Service and Responsibility



TRADE MARK
HB DWF
HESS-BRIGHT
THE INIMITABLE BEARING

Little motors frequently do big service.

The Holtzer-Cabot motor **geared** to this machine is an instance.

To bring trouble hazards down to an irreducible minimum it is equipped with Hess-Bright Ball Bearings—**advisedly** so.

HESS-BRIGHT MANUFACTURING CO.
Philadelphia, Pa.

Hess-Bright Conrad Patents are Thoroughly Adjudicated

Peirce Forged Steel Pins

For Your High Voltage Lines

How strong a pin do you want?

Phantom view of short shank Pin for Angle Steel Arms and Bo-Arrows

Operating engineers and insulator manufacturers agree that a pin and insulator, considered as a unit, should not deflect more than 10 degrees from the vertical when subjected to the greatest loads it will encounter in service. This is because when the deflection gets very much beyond 10 degrees the inner shell of the insulator is forced against the side of the pin and is broken out.

Keeping this 10 degree limit in view, we have designed two series or classes of Forged Steel Pins; one a 1500 pound series for general line construction, and the other a 3000 pound series for heavier work, and in addition to these, we can furnish you for special requirements a pin of any strength you want. To illustrate: A pin of our 1500 pound series, of any length from 3½" to 16" above the cross arm, will stand a pull of its rated load, 1500 pounds, applied at the line wire groove of its insulator with a deflection of not more than 10 degrees from the vertical.

A 1500 Pound Pin tested to 1650 Pounds

Another valuable feature of the Peirce Forged Pin is that it is so designed that its bending under excessive loads takes place near the base of the pin and accordingly deflections of very much more than 10 degrees are required to break the inner shell of the insulator against the pin. On the other hand, in a cast iron pin composed of a separable thimble, a long through bolt and a cast cone or shell, subjected to load, the deflection takes place entirely in the thimble on account of the stretching of the long through bolt, which permits the thimble to tip over so that the only question is whether the inner shell of the insulator will be broken and allow the insulator to flash over and burn off the line wire, or whether the cone will break on its lower edge on account of the concentration of the compression stress on a very small segment of its base.

Short Bolt Type, unassembled

We have never heard of a broken Forged Steel Pin

You will find a table giving the proper length of pin for your insulator on pages 58 and 59 of your 1916 Hubbard Catalogue, or on pages 12 and 13 of our Forged Steel Pin Booklet, "Continuity and How."

A 3000 Pound Pin tested to 3225 Pounds

The Hardware MAKES the Line—Hubbard Makes THE Hardware

HUBBARD AND COMPANY

PITTSBURGH

NEW YORK CHICAGO SAN FRANCISCO

Something Good for Live Wires

Agents and Dealers—Attention!

THE National Fuse has all the safety features of an old style standard fuse with the economy of a refillable fuse. In fact, it is a simple combination of the two types. The cartridge which is replaced when the fuse blows is, in effect, a complete standard fuse with cooling powder. You save, however, the strong fibre case and heavy metal terminals. Since the cartridge costs only one-sixth of the complete fuse, the saving is evident.

The National Fuse has completely overcome all previous objections to a refillable fuse. There are only three parts: the holder, the cartridge and the cap. It is the work of a few seconds to replace a blown cartridge. The operation is so simple no mistake can be made.

The rating is plainly stamped on every cartridge and you cannot get it in the wrong case. Furthermore, a wire or strip of metal cannot be substituted. Every fuse is correctly rated and enclosed in a protecting tube filled with cooling powder. You cannot make a poor connection.

The National is the last word in fuses. It has all of the advantages and none of the objections. You will agree that it is the solution of the fuse problem.

We want dealers and agents in every city.
Let us explain our proposition to you.

Federal Sign System (Electric)

Lake and Desplaines Sts., Chicago, Ill.

Branches in all Large Cities

Why Turn Your Back on the Socket?

Good lamps are essential. Good fixtures. Good wire. Good installation. Why not good sockets?

P&S Sockets and Receptacles

if you please.

Just because the socket is comparatively small in bulk, is no evidence that it is not just as important in function, as lamps or wire or fixtures, or any other part of electrical installations.

A lot of people get into the habit of thinking that "a socket is a socket and that's all there is to it."

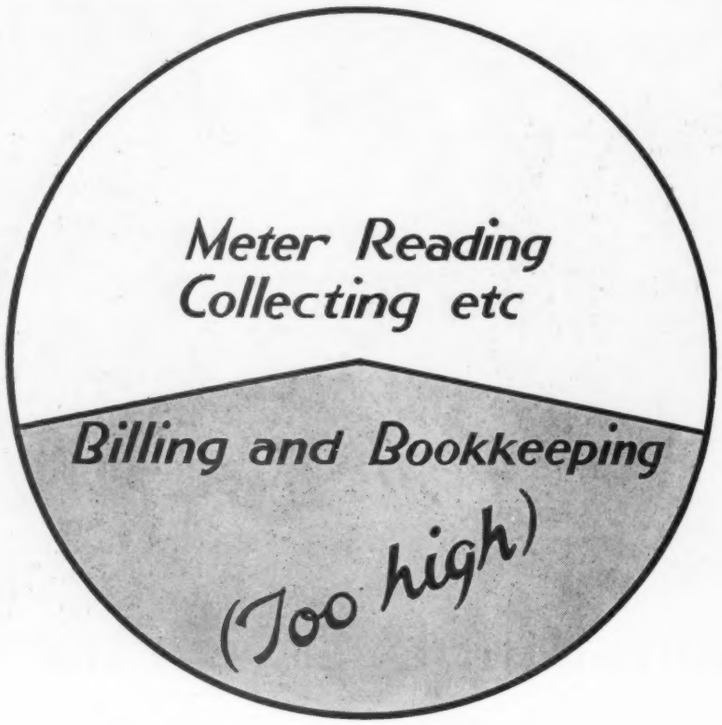
Maybe so. But we have spent something over 20 years in making sockets and in learning that there are right ways and wrong ways of doing it.

Furthermore, we have learned that the right way always means value to our customers and the wrong way means trouble for them. So we stick to the right way.

Keep the socket question before you—not behind. The more you study it the more you will appreciate its importance, because the socket is

"The Gateway of Electric Service"

Pass & Seymour, Inc., Solvay, N. Y.



Investigate This Part Of Your Meter Bill Cost

A prominent central station executive says:

"If we can obtain better results, as we undoubtedly can, by studying our expenses, they are of great value to the company. The expenses are something we can control more easily than we can control income."

Billing and bookkeeping usually form an *expense* that is capable of *big* reduction.

—usually offer opportunity for more accurate work.

This company has put such work on a scientific basis.

It has provided a means which fits into present practice and eliminates the chance for error.

—reduces the handling cost of meter readings.

—obviates the end of the month rush.

—cuts the cost of such work to a point which makes the economy *pay* for the method in a few months.

Establish *your* present cost for the service—then compare it with costs of some station that utilizes the *results* we sell.

Write us now for such a station's figures.

ELLIOTT-FISHER COMPANY
631 Cameron Parkway, Harrisburg, Pa.
Offices in All Principal Cities

WEIGHT, ONLY 25 POUNDS

Esterline Portable Graphic Meters

Enabled this power company to increase its load 750 per cent in eighteen months.

Hundreds of public service companies use these meters for checking conditions before fixing rates.

The ability of YOUR power solicitor to give close contracts will encourage your customers to use more power, and your commercial load comes when generators otherwise would be idle.

Esterline meters do not guess. They give you accurate data on which to base your estimates. Charts in 90-foot lengths permit you to obtain continuous unqestionable records for any length of time.

Satisfied power users are boosters.

An Esterline graphic meter can be carried from place to place to check actual conditions. They can give as much as 12 inches of record chart in a minute, or only 10 feet in a week, with possibility of 8 other chart feeds.

An Esterline meter gives a continuous record in ink on a paper chart, of amperes, volts, kilowatts or temperature. Its evidence is permanent.

Esterline meters are noted everywhere for their reliability, accuracy and simplicity. Power users do not question rates established by such records, and YOU are sure of your load.

Supplied Also in Switchboard, Wall and Desk Types

Write for Catalogue 321W

The Esterline Co.
232 East South Street
Indianapolis, Ind.

Crawfordsville Electric Light and Power Co.

Crawfordsville, Ind.

February,
Tenth,
1914.

The Esterline Company,
227 South Street,
Indianapolis, Ind.

Gentlemen:

You will be interested no doubt in the enclosed chart which shows an increase of 750 per cent in our power load during the past eighteen months.

Ever since we began soliciting power consumers, we made it a practice to carefully analyze the load of all large prospective customers, using your graphic recording meters.

Each motor equipment was also tested under working conditions after installation and the records preserved for reference.

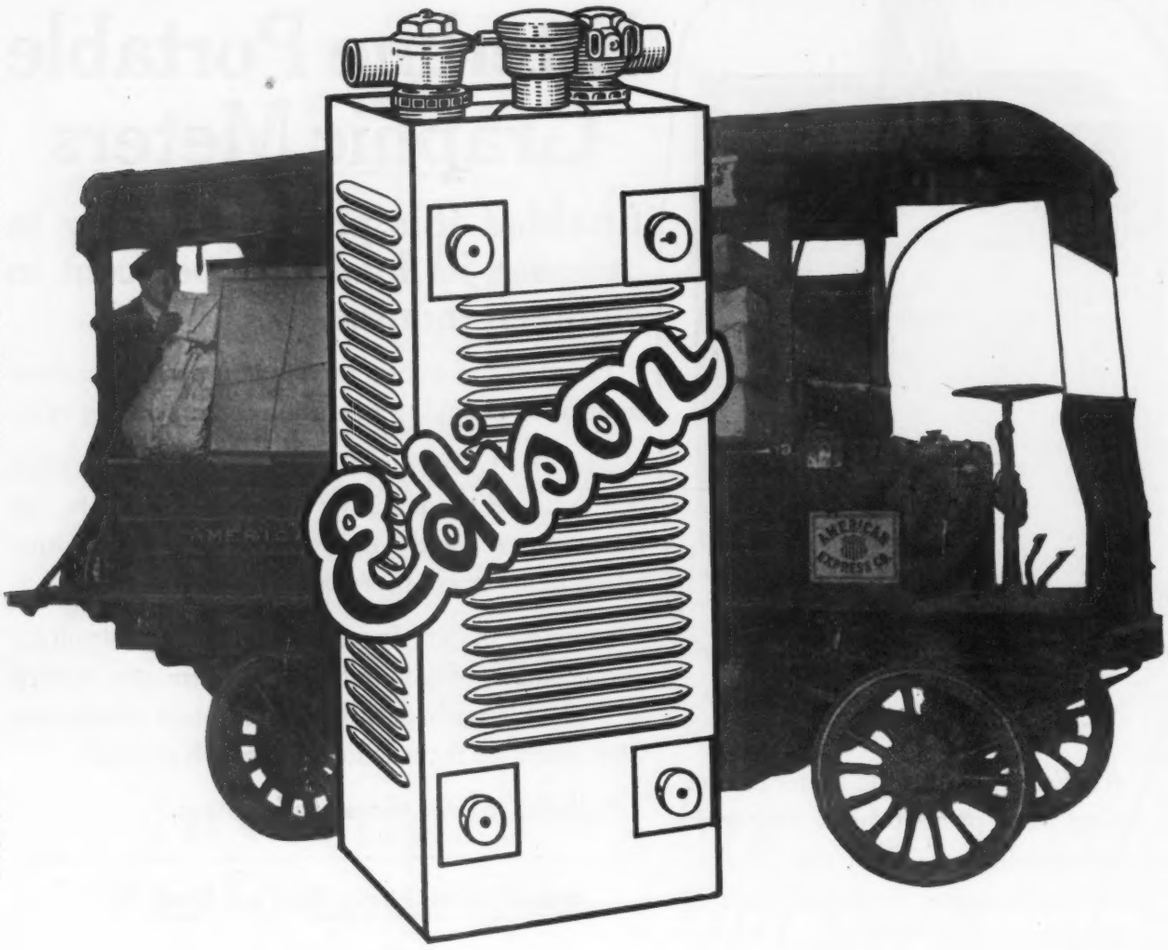
The result is this: every customer's monthly bill has verified the correctness of our estimate; motors are properly and efficiently loaded; our customers are boosters for electric power.

For the power solicitor, I know of no equipment so valuable as a portable graphic meter.

Yours very truly,

Crawfordsville Electric Light & Power Co.

J. R. Thomas, Supt.



The factor that made electric delivery the most economical and reliable method of street transportation was the

Edison Alkaline Storage Battery

The Edison Storage Battery is made throughout of **steel—steel plates, steel poles, steel jars,**—there is nothing to bend, buckle or crack.

Many Edison Batteries in present operation were installed over six years ago and are still performing their daily work satisfactorily **without renewals** of plates, separators or jars. This is one factor in LOW MAINTENANCE COSTS.

Practically no repairs means high service efficiency, no lay-ups, on the job every day, no disarrangement of delivery schedules.

The Edison Storage Battery is made on a scientifically correct principle, active elements consisting of nickel-hydrate (positive) and iron oxide (negative) submerged in a non-acid solution. It gives off no corrosive fumes; is free from the troubles common to other batteries.

Its life is longer.

"How long?"

Over six years' daily work have failed to establish the "old age" limit for Edison Batteries.

Physically and chemically Edison Batteries are entirely different from all other makes.

The thousands of Edison Alkaline Storage Batteries used in all parts of the country enable our engineers to speak with authority in recommending equipment. Their experience and advice is at your disposal on request.

WRITE FOR BULLETIN 500 ON COMMERCIAL VEHICLE BATTERIES.

Edison Storage Battery Co., Main Office and Factory Orange, N. J.

Distributors in New York, Boston, Chicago, Detroit, Washington, San Francisco, Los Angeles, Seattle, New Orleans

Jim Knew That

Northern White Cedar Poles

Stand Against the Storm

"Jim," said the superintendent of construction to the foreman, as they listened to the sixty-mile gale howling outside, "I'm afraid we're in for a lot of trouble. That's a mighty stiff wind; there's tons of sleet on the wires and all our poles are carrying big loads without that ice. Looks to me as if we're apt to have lines down all over town before this storm breaks."

"Don't worry, Boss," said Jim. "Our poles will all be standing up straight as ramrods when this wind quits. I set most of those poles and I know what they are. They're all good, straight Northern White Cedar. They've bucked many a stiff wind before and they'll do it this time.

"I never worry about Northern White Cedar poles, no matter how hard the wind blows. I can build a line with Northern White Cedar that'll beat any kind of new-fangled factory-made pole or any of this cheap wood stuff that they try to palm off sometimes as cedar. I always think I've done a good job after I've put a line of Northern White Cedar poles in the ground."

Jim is right. **Northern White Cedar** poles insure a line of long service, and minimum costs, either for construction or maintenance.

Northern White Cedar is the wood that offers greatest resistance to decay. It stands up for years under the hardest usage; it is light weight and easily transported; it is a non-conductor of electricity, therefore a safe pole for workmen; it is easily climbed. It makes a straight, symmetrical line.

The supply of **Northern White Cedar** is ample for generations to come.

For further information write

Northern White Cedar Association

Lumber Exchange **Minneapolis, Minnesota**

Getting Over to the User's Side

There isn't an automobile today that even looks like any of the early models.

The first auto makers couldn't think of a new design of vehicle. They simply applied power to the old design—high wheels and all.

But each year thereafter they scrapped the previous year's designs and got closer to what the public wanted.

Today there isn't a solitary convenience or efficiency device that is not provided in the 1916 model.

And who can say that the industry hasn't prospered as a result of this policy of give-what-the-user-wants?

What changes of design have been made in electric motors during the time that the auto was redesigned and re-redesigned?

Few.

And consequently the price of motors has remained stationary in the face of advancing costs.

—and the popularity of motor drive is NOT at its maximum.

It is a simple matter to sell the public—and at your price—if you have what that public wants.

The motor-using public wants a trouble-proof motor.

—it wants a motor with lubrication and inspection work removed.

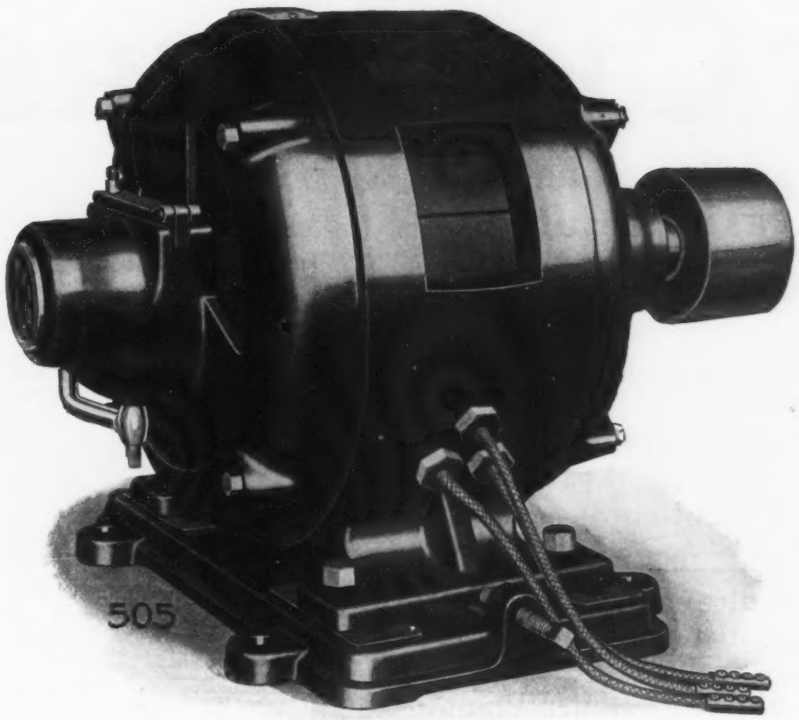
—it wants a motor that precludes the possibility of burnout due to worn plain bearings.

Double-row, self-aligning ball bearings on motors are providing just those features.

S K F Ball Bearings reduce upkeep cost and increase the durability of motors.
Rolling action is substituted for the rubbing friction of plain bearings.
Greater simplicity and cleanliness result and give the user a more compact motor—10% to 25% shorter in over-all length.
Lubrication—or even inspection is not necessary more than once in three or four months.
S K F Ball Bearings are positive self-lubricators—the balls being encased in sealed bearing heads, there is no leakage.
"No equipment helps sell the motor as readily as S K F Double-Row, Self-Aligning Ball Bearings."
Balls and races made of Swedish Crucible Steel.
Write us for book on what motor makers are doing.

SKF BALL BEARING CO.
HARTFORD, CONN.

Examine the Bearings When You Buy Induction Motors



The bearings of an induction motor are about the only parts which are subject to wear. You can measure the service a motor will give by the strength and durability of the bearings.

Unusual strength and durability are conspicuously apparent in the bearings of The Robbins & Myers Type "K" Motor. So great is the factor of safety in their design that one of end head and bearing can be removed, allowing the weight of the rotor to be carried on one bearing alone, and the motor will operate without vibration or heating in the remaining bearing. This test has been made time and again with Type "K". We invite you to make the test on any Type "K" motor.

In addition to their great strength and durability, Type "K" bearings are dustproof. They will give years of service in localities where dust and grit fill the air, as in cement mills, mines, etc.

The Type "K" bearing insures long, reliable service for the user and good will for the dealer or contractor who sells the motor.

Bulletin No. 123 gives complete specifications of this motor in sizes from ¼ to 25 horsepower. Copy on request.

THE ROBBINS & MYERS COMPANY

SPRINGFIELD, OHIO

New York Boston Philadelphia Cleveland Cincinnati
Rochester Chicago St. Louis San Francisco

VULCAN
SOOT CLEANERS

followed naturally as a result of—

High Capacity Stokers and Overloads.
High Settings.
Large Boilers.
The Demand for Efficiency and low flue gas temperature.
The necessity for eliminating air infiltration and use of steel casings.
The necessity for prevention of accidents, etc., etc.

The installation of Vulcan Soot Cleaners in the boilers of the largest modern plants, has come to be almost universal.

You will find the subject of Boiler Plant Economy from the standpoint of soot and ash deposits and appliances for their removal thoroughly discussed in the New Vulcan Book. Copies will be sent to engineers actually interested.

Ask for Catalog W.

Vulcan Soot Cleaner Co.
25 North Brady Street
Du Bois, Pa.

Soot cleaners for all types of Water Tube and Fire Tube Boilers, Over a million Horse Power installed

Read this synopsis of contents telling you what the new Vulcan Book contains. Copies will be sent you if you are actually interested in the subject.

Frontispiece—A four-color reproduction of actual specimens of soot from different boilers and with different fuels.

Section I—"What Soot Really Is" points out the predominance of ash in most soot and what happens if this is allowed to accumulate, not only as to reduction in efficiency, but by reason of the fusing and hardening of the deposit. Soot with anthracite, bituminous, garbage, oil, waste gases and with economizers, are considered separately.

Section II—"Why Clean Heating Surface Pays"—Results of a large number of tests and investigations on the effect of soot deposit on efficiency of heating surface in boilers, superheaters and economizers are presented in this section to demonstrate the value of clean heating surface from a commercial standpoint. The reduction in flue gas temperature with boilers is on the average 100 deg., representing a saving of about 5% in fuel with the Vulcan Soot Cleaner, as compared to hand-blowing methods. The temperature of gases leaving economizers can also be decreased—in one case 31 deg.—by the use of the Vulcan Soot Cleaner as against scrapers.

Section III—"How Soot Cleaning Can Be Accomplished." This section discusses the fundamental requirements of soot cleaning and what can be accomplished with hand blowing. Brief consideration is given the growth in the size of boilers and height of settings, the danger of accidents, the cost of labor, the space requirements, air in leakage, loss of capacity, all of which hinder or detract from the value of hand blowing. This is followed by a discussion of mechanical soot cleaning, which includes the principles of design of steam nozzles and their location in the boiler in order that their cleaning effect may reach all of the surface.

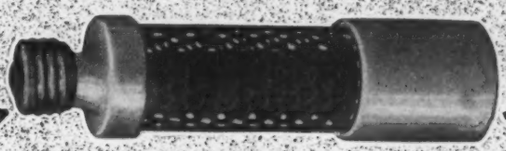
Section IV—This section takes up the design of the Vulcan Soot Cleaner as applied to different types of water tube boilers, including horizontal boilers of the B & W type, boilers of the same type with special baffling, Stirling type boilers, including large W type Stirling boilers, the Edge Moor boiler, the Heine and Keeler types, the Erie City vertical and horizontal types, the Oil City type, the Badenhausen, Rust and Wickes boilers, and the Flanner or Springfield type.

Section V—This is devoted to the Vulcan Soot Cleaner as applied to different types of fire-tube boilers, including the return tubular boiler, the Scotch marine, and the Manning boiler.

Section VI—is devoted to the application of Vulcan Soot Cleaners to Economizers, illustrating the design for both the straight and staggered tube types of economizer.

Section VII—"Details of Construction of the Vulcan Soot Cleaner." This section discusses the design of nozzles, anti-corrosion air relief valves and automatic telltale drain valves.

WARD LEONARD
Adaptor Resistance



Vitreous Enamel assures that the resistance wire as well as the joint between the resistance wire and terminal lead will not be affected by chemical, electrical or mechanical depreciation.

Edison Base Screw Plug

A convenient means of interposing resistance in a circuit

Standard Edison Socket

Any desired capacity or resistance

Price 50 Watt Size $1.60 List with Liberal Discounts

Ward Leonard Electric Co., Mt. Vernon, N. Y.

Badt Westburg Electric Co., Chicago

John B. Sebring, Pittsburgh, Pa.

Pittsburgh

Mill Type

Transformers

Are installed in most of the largest Steel Mills and on the lines of the largest Power Plants in this country.

The heavy duty called for in Steel Mill practice has been met most successfully in this type—which embodies the strongest mechanical structure in any transformer ever produced.

Pittsburgh Transformer Company

NSANSILWA

is the pot of hot water started up by the Bakongo native after a girl baby is born.

The one who drops the first bead into it during the first two days can claim the girl for his future wife.

It's taking an awfully long chance to pick a winner—just as long as writing for a set of Cat. No. o½ carbon brushes to correct some brush troubles.

You may hit it right, but the odds against it are big.

How much *more* scientific it is to ask a Morgan engineer to study your service and prescribe a type of Morganite brush built *especially* for that service?

You take no chances when *our* chances for future business depend solely on the success of that prescription and our ability to *cut* your brush bills.

It's *your* move.

The Morgan Crucible Company Limited
116 Liberty St, New York City

Factory, Brooklyn, N. Y.

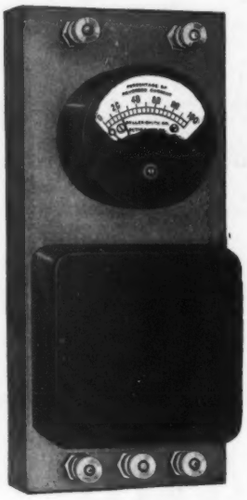
AGENTS:

Lewis & Roth Co., 312 Denckla Bldg., Philadelphia
Electrical Engineering & Mfg. Co.
First National Bank Bldg., Pittsburgh
W. L. Rose Equipment Co.
La Salle Bldg., St. Louis, Mo.
Herzog Electric & Engineering Co.
150 Steuart Street, San Francisco, Cal.

THE RIGHT KIND OF PROTECTION

for Generators Operated in Parallel

When generators are operated in parallel it is not only important but it is imperative that each one be protected against reversal of current as well as overload. In such installations it frequently happens that one machine is not carrying its proportion of the load—in other words instead of acting as a generator it is being driven as a motor. This may be due to any one of several causes. Failure of the prime mover or loss of field excitation is usually the trouble. When this happens the crippled machine should be promptly and completely disconnected or trouble will inevitably follow.



The most satisfactory equipment for this application is the

ROLLER-SMITH REVERSE CURRENT RELAY

in connection with a Roller-Smith shunt trip circuit breaker. The relay is connected across an ammeter or watt-hour meter shunt and the circuit breaker in series with the machine, its shunt trip coil being operated from any available source of potential through the relay. The pilot needle may be set at ANY desired percentage of reverse current value. As soon as there is a reversal of current the pointer moves up the scale, touches the pilot needle and the circuit breaker is instantly tripped. The three units, shunt, relay and breaker work together so harmoniously that the desired result is accomplished in a very small fraction of a second.

If you have a proposition of this kind put it up to us. We will make proper recommendation and furnish the right equipment.

"Send for Bulletin No. 75"

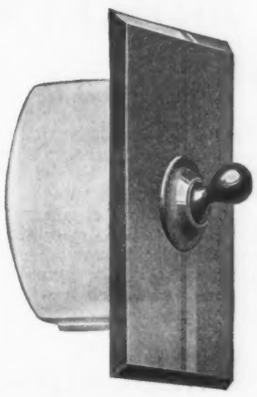
Roller-Smith Company
233 Broadway, New York

CHICAGO Monadnock Block
Factory: Bethlehem, Pa.
CLEVELAND Williamson Bldg.

Boston—77 Franklin St.
Baltimore—Equitable Bldg.
Detroit—Majestic Bldg.
Kansas City—600 E. 15th St.
Minneapolis—First National-Soo Line Bldg.
Seattle—Henry Bldg.
San Francisco—589 Howard St.

ROLLER SMITH

NEWTON TOGGLE SWITCH



This is a new wall switch embodying the only radical improvements in switch practice made in recent years, viz., lever movement instead of push-buttons, and a switch plate about two-thirds the size of the ordinary 2-button switch. These, in combination, make the **Newton Toggle Switch** so small and inconspicuous that it makes instant appeal to architects and home builders. It is distinctly **the** switch for the 20th century home where beauty and utility are combined.

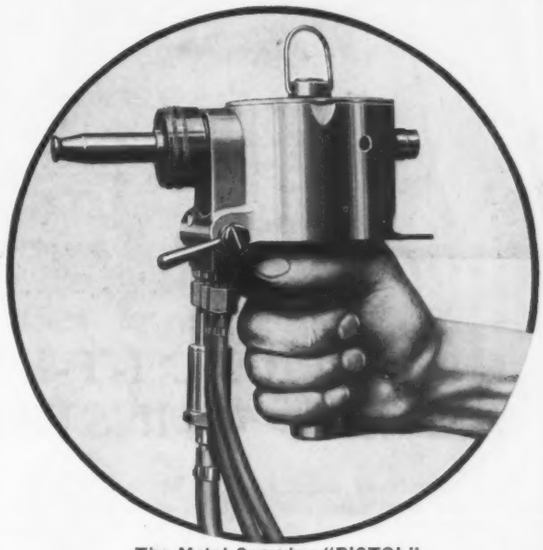
Write for the new booklet giving description, styles, finishes and prices.

NEWTON MANUFACTURING COMPANY

ELECTRICAL APPLIANCES

LYNBROOK, NEW YORK

Where PROTECTION Counts



The Metal Spraying "PISTOL"

The Schoop Process of Metal Spraying

Copper coatings on switchboard fittings, contacts, carbon brushes, wireless condenser plates, resistance rods and many other electrical parts are successfully and economically treated with this process. In the construction of storage batteries this method provides an extremely efficient aid and deposits of lead coating protect the attendant equipment. Copper connectors are protected from the attack of acids by spraying them with lead and many other battery parts can be similarly treated.

Instantaneous coatings of any of the lower fusing metals can be applied with permanent results to practically any coherent surface.

For full information write for Booklet "C".

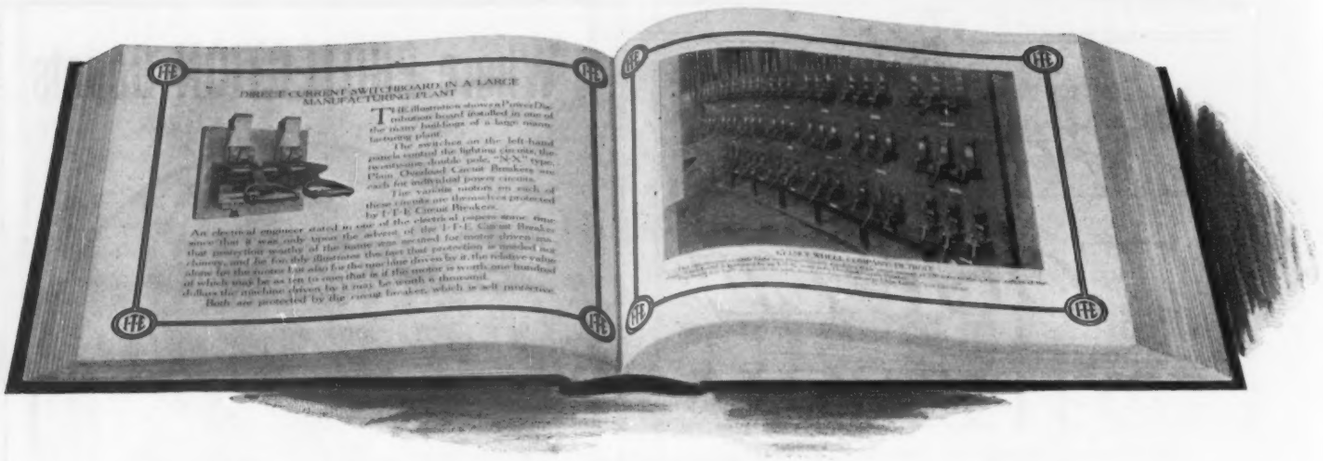
The

Metals Coating Company of America

100 Summer St. Boston, U. S. A.

NEW YORK 30 Church Street

CHICAGO 122 S. Michigan Ave.



TYPICAL I-T-E CIRCUIT BREAKER INSTALLATIONS

A large number of installations in which I-T-E Circuit Breakers have been used are shown in a volume about 350 pages, handsomely printed on fine paper, 9″ x 11″, substantially bound.

To consulting and operating engineers who have specified our apparatus, the book will be sent with our compliments, if they will request us to do so upon their regular business stationery.

Many consulting engineers are well known to us by reason of their continued use of our apparatus. From these also we ask a request for the book, solely that we may be advised as to their correct names and present addresses in order that the book may not be missent, as the number available for free distribution is necessarily limited.

It is believed that consulting engineers and others contemplating new electrical equipment or additions to existing plants will find this book stimulating and suggestive.

The price has been set at the actual cost of publication, namely $5.00, on receipt of which it will be delivered free of all transportation charges.

THE CUTTER COMPANY, Philadelphia

AS OLD AS THE INDUSTRY

CREW LEVICK

TURBOGLIO

Not only lubricates but protects the hydraulic turbine bearing surfaces from corrosion, even in acid or alkaline waters.

Keeping a machine lubricated under ordinary conditions presents many difficulties, but keeping bearing surfaces lubricated that are *submerged in flowing water* has been a matter of extraordinary difficulty—until the introduction of TURBOGLIO. The great advantage of TURBOGLIO is its ability to *cling* to metallic surfaces. It won't wash away; it *sticks* and not only lubricates but protects from corrosion.

Write for Data—NOW.

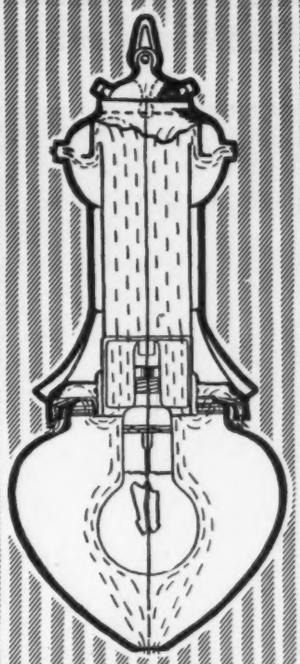
HYDROGLIO

Costly hydraulic governor oils are now unnecessary; use WATER plus HYDROGLIO for your governor fluid.

Water — ordinary pure *water* — becomes an excellent governor fluid when 2% HYDROGLIO is added to it. And it's so much cheaper than governor oils you can't afford not to use it. HYDROGLIO is now used in governors controlling turbines aggregating 155,000 H.P.

Get Facts and Figures

CREW LEVICK CO., Philadelphia, Pa.



Convert Your Arcs

You may retain the same lightning equipment as originally planned by having your arc lamps converted for use as type "C" lamp containers The Metropolitan method increases the life of your lamps & therefore the efficiency. *Get our proposition before investing in new equipment*

Metropolitan Engineering Co

Thirty-five Vestry Street New York

M E C

Canadian Representative Metropolitan Engineering Co. Ltd 90 Sherbourne St. Toronto – Canada

THE SATURDAY EVENING POST
EVEREADY
SAFETY LIGHTS
The light that says
"There it is!"
Look for the Eveready Dealer with this sign in his window
What! Going away this summer without an Eveready?
EVEREADY
DEALERS EVERYWHERE

Turning the lights of publicity full on the EVEREADY DEALER'S STORE—

that is what EVEREADY advertising is doing, and *keeps* doing—for EVEREADY dealers. And with the display material, which we furnish, EVEREADY dealers are making this advertising *work* for them—and bring them customers, not only for EVEREADYS but for the many other lines they carry.

From Saturday Evening Post

American Eveready Works,
of National Carbon Co.,
Long Island City, New York

Being an EVEREADY dealer is worth while—fill in and return the attached coupon **NOW.**

Send me full details of your free display and sales helps, also your proposition to dealers, 45.

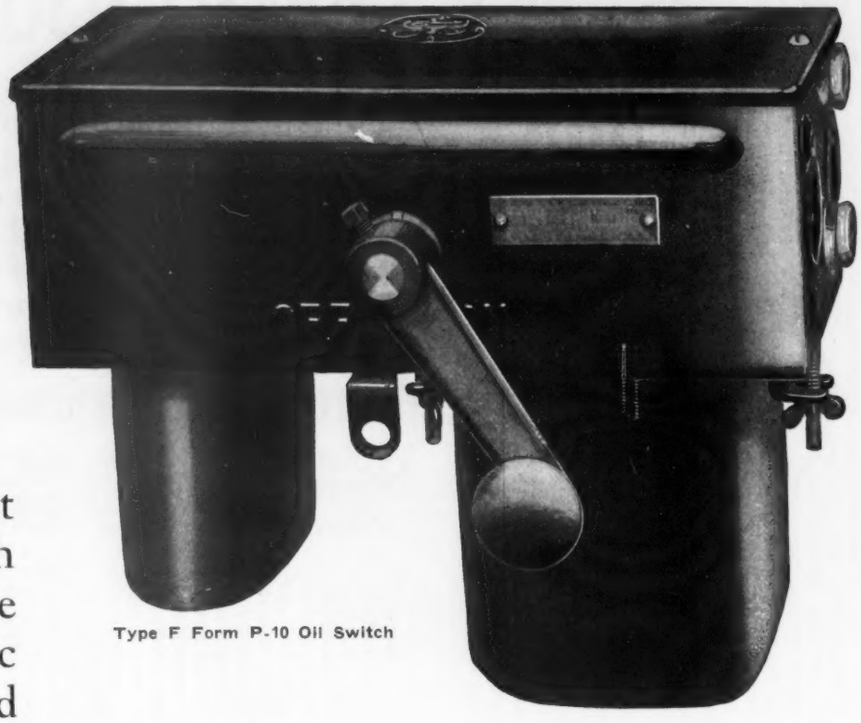
.....

.....

This Trade Mark The Guarantee of Excellence on Goods Electrical.

This new Oil Switch

gives Safety at low cost



Type F Form P-10 Oil Switch

This is the lowest priced oil switch manufactured by the General Electric Company. It is used for controlling small induction motors, and for the service recommended is unsurpassed. All live parts, and all moving parts except the operating handle, are totally enclosed, and the switch meets all the requirements of the "Safety First" movement.

The switch is furnished non-automatic, or with either overload trip or low voltage release. The operating handle can be locked open, insuring against accidental or unauthorized operation.

This switch is recommended for 550 volt motors up to 10 horse power, or for currents up to 30 amperes at less than 550 volts. It is small, compact, simple and durable.

Complete description and prices on request.

General Electric Company

General Office: **Schenectady, N.Y.**

Sales Offices in All Large Cities

5684

This Trade Mark The Guarantee of Excellence on Goods Electrical.

This Trade Mark The Guarantee of Excellence on Goods Electrical.

FORM C RI Motors

60 Sales Offices

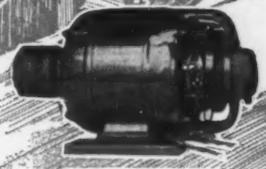
2500 GE Motor Agencies

General Electric Company

54043 CAP 40000 LBS 100 NEW 10 Rush

Now Ready For Delivery

A New Line of Single Phase



The 1-2 H. P. Size

Form C RI Motors

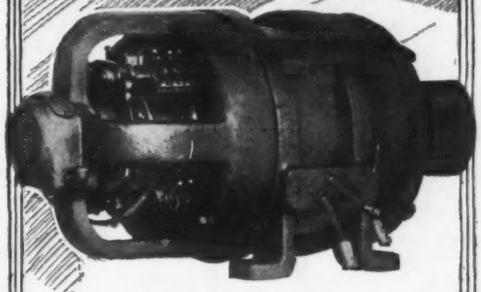
have no centrifugal switches or clutches. They deliver 2 to 2½ torque at start and accelerate in 2 to 5 seconds.

R.I. Motors operate quietly and have no tendency to spark.

Will carry 50% overload for short periods.

Power factor and efficiency sustained at all loads.

The 2 H. P. Size



The 20 H. P. Size

Form C RI Motors

In sizes ranging from ¼ to 20 H.P.—constant or variable speed. Can be shipped promptly. Are easily installed. Mechanical construction is simple, strong and durable.

Low starting and running current.

Reversible operation through double throw switch.

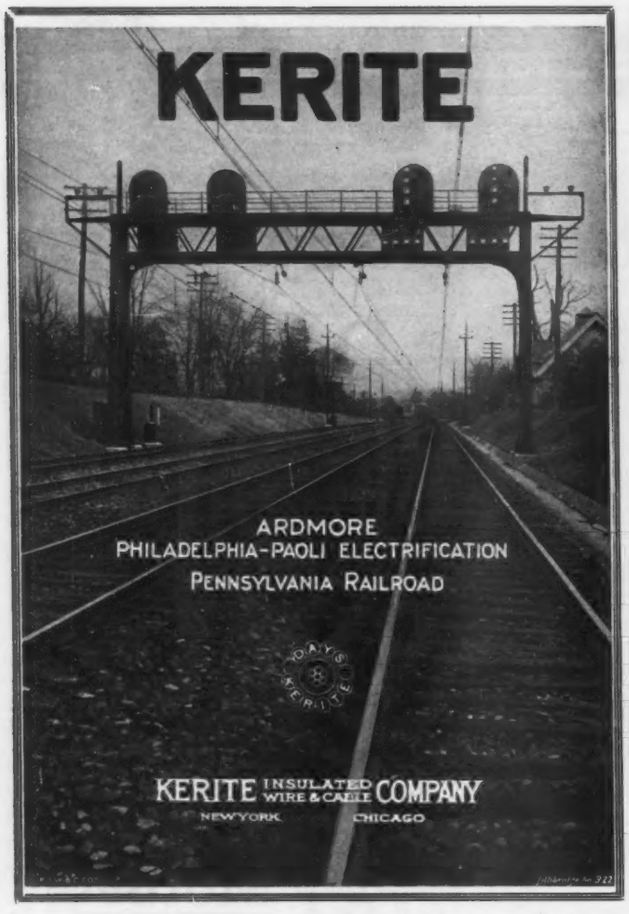
Information on these motors and latest types of control furnished on request.

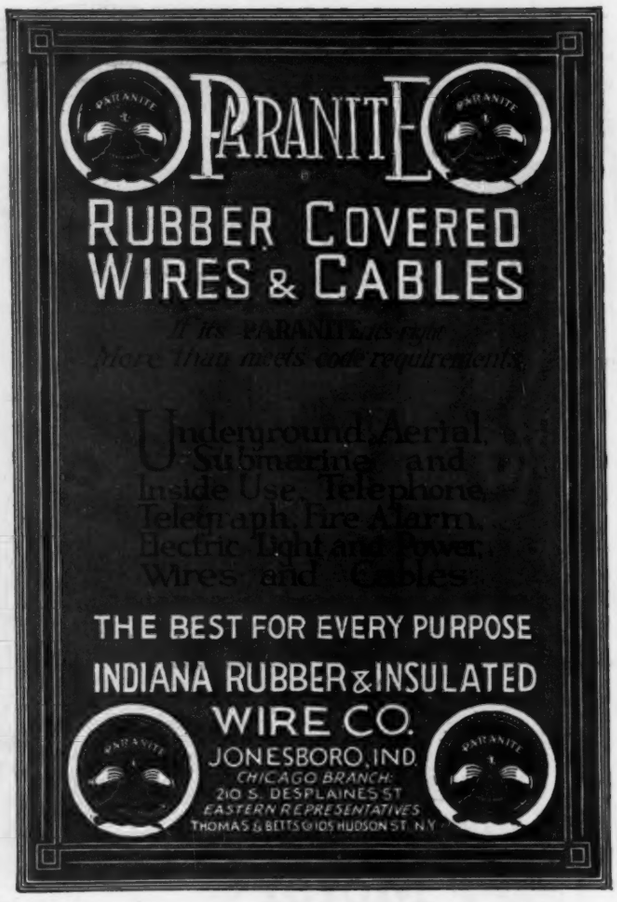
General Electric Company

General Office: 2500 G. E. Motor Agencies Sales Offices in All Large Cities Schenectady, N. Y.

6164

This Trade Mark The Guarantee of Excellence on Goods Electrical.


KERITE
ARDMORE
PHILADELPHIA-PAOLI ELECTRIFICATION
PENNSYLVANIA RAILROAD
KERITE INSULATED WIRE & CABLE COMPANY
NEW YORK CHICAGO


PARANITE
RUBBER COVERED
WIRES & CABLES
THE BEST FOR EVERY PURPOSE
INDIANA RUBBER & INSULATED
WIRE CO.
JONESBORO, IND.
CHICAGO BRANCH:
210 S. DESPLAINES ST.
EASTERN REPRESENTATIVES
THOMAS & BETTS CO. 105 HUDSON ST. N.Y.

THE STANDARD FOR
RUBBER INSULATION
OKONITE
OKONITE
is to-day what it has always been, the highest quality of insulation on the market, and is made in but one grade—the BEST.
THE OKONITE CO.
253 Broadway
New York

PULL THE SIMPLEX STRING
EVERY PAPER WRAPPED COIL of Simplex Wire has it.
SIMPLEX
SIMPLEX WIRE & CABLE CO.

On Approval

AMERICAN ELECTRICIANS' HANDBOOK
TERRELL CROFT

No Money in Advance

Electrical Practice Complete

Thousands of men in all branches of the electrical industry are solving their daily problems with Croft's Handbook.

Are YOU?

From electrician to electrical engineer they agree as to its completeness and practical application.

Croft's Handbook was built with the needs of the practical man clearly in mind.

Within its 700 pages are solutions to all your everyday electrical problems.

In addition, there are over 900 illustrations which show you exactly the right way to handle all kinds of electrical work.

Brief List of Contents

I. FUNDAMENTALS—A reference section on principles of electricity and electrical engineering. 156 *pages*, 159 *illustrations.*

II. GENERATORS AND MOTORS—Characteristics and Management—Troubles and Remedies—Direct and Alternating Current Machinery—Starting and Controlling Devices—Installation. 172 *pages*, 136 *illustrations.*

III. OUTSIDE DISTRIBUTION—Pole Lines—Underground Conduits—Transformers—Design of Systems, etc. 72 *pages*, 118 *illustrations.*

IV. INTERIOR WIRING—Every detail for all kinds of wiring, including old buildings, signs, etc. 190 *pages*, 274 *illustrations.*

V. TRANSFORMERS — Connections — Operation — Types — Special Forms—Installation. 50 *pages*, 58 *illustrations.*

VI. ILLUMINATION—Interior and Street—Type of Lamps —Design—Installation, etc., etc. 50 *pages*, 40 *illustrations.*

Two Useful Books for the Man in Practical Electrical Work

Croft—

Wiring of Finished Buildings

By TERRELL CROFT, Consulting Engineer

275 pages, 5½ x 8, over 200 illustrations, $2.00 (8/4) net, postpaid

Combines in a single volume both the **commercial** and **technical** aspects of the subject. The material is all presented in clear, concise form.

CHAPTER HEADINGS. — Commercial Section. — I.—Possibilities and Results. II.—Advertising. III.—Solicitation. IV.—Policies. V.—Examples of Campaigns. VI.—Costs and Prices. Appendix to Commercial Section. Technical Section.—VII.—Methods of Wiring. VIII.—Planning Installations. IX.—Tools and Manipulation. X.—Examples of Installation. XI.—Fixtures.

Moxey—

The Electrical Contractor

By LOUIS W. MOXEY, JR., Vice-President, Keller-Pike Co., Philadelphia, 86 *pages, 6 x 9, cloth, illustrated,* $1.50 (6/3) *net, postpaid.*

This book has been written to help the contractor to better business methods and better profits. It embodies the experience and data of 20 busy years in this field. It covers the principles of cost-keeping and estimating, wiring and illumination calculations and other technical problems of the business.

CONTENTS.—I. Profit and Overhead Expense. II. Bookkeeping. III. Cost-keeping. IV. Estimating. V. Calculating Wire Sizes for D. C. Currents. VI. Calculating Wire Sizes for A. C. Currents. VII. Illumination Calculations. VIII. General Data.

Sent for Free Examination

We will send these books or any book published by the McGRAW-HILL BOOK COMPANY, Inc., to any subscriber to the ELECTRICAL WORLD or any member of the American Institute of Electrical Engineers for 10 days' free examination.

If you are not a subscriber to ELECTRICAL WORLD or a member of the American Institute of Electrical Engineers, a reference will give you the same privilege.

No books sent on approval outside of the United States or to booksellers and agents.

McGRAW-HILL BOOK CO. INC.
239 WEST 39TH STREET, NEW YORK

LONDON: HILL PUBLISHING CO., LTD.
6 & 8 BOUVERIE ST., E.C.

Publishers of books for the Electrical World

FREE EXAMINATION COUPON

McGraw-Hill Book Co., Inc.,
239 West 39th Street, New York, N. Y.

You may send me on 10 days' approval the books checked:

- — **Croft—American Elec. Handbook $3.00 net**
- — **Croft—Wiring of Finished Buildings $2.00 net**
- — **Moxey—The Electrical Contractor $1.50 net**

I agree to pay for the books or return them postpaid within 10 days of receipt.

....I am a regular subscriber to the Electrical World.
....I am a member of A. I. E. E.

(Signed) .....

(Address) .....

.....

Reference .....W 6-24

(Not required of subscribers to the Electrical World or members of A. I. E. E.)

Directory of Engineers

W. G. ABBOTT, Jr.
Research Engineer
Processes Electrical
Inventions Chemical
Special Machinery Mechanical
Laboratory, Wilton, N. H.

JAMES R. CRAVATH
Consulting Engineer
Illumination, Management and Operation of Electric Light and Power Companies.
Telephone, Randolph, 7184.
140 South Dearborn Street Chicago

EDWIN G. HATCH
Consulting Electrical and Mechanical Engineer
Investigations, related engineering and business subjects; Street Railway; Electric Light, Industrial Plants; New Processes; Inventions. Earning Power Developed. Plants designed. Specifications. Inspections. Tests. Purchasing. Foreign Shipments. Bond Issues arranged.
845 Equitable Building, New York

AMERICAN DISTRICT STEAM CO.
Engineers and Contractors
for
Central Station Heating Systems
General Offices and Works:
NORTH TONAWANDA, N. Y.
Chicago First Nat. Bk. Bldg. New York West St. Bldg. Seattle Hoge Bldg.

DAY & ZIMMERMANN
Engineers, Contractors, Operators, Public Utilities and Industrial Plants.
611 Chestnut Street, Philadelphia, Pa.

JOHN C. HORNUNG
Consulting Engineer
Designs, estimates and reports on Central Stations and Industrial Heating Plants, alone, or as part of Light and Power Plants.
343 So. Dearborn St., Chicago

THE ARNOLD CO.
Engineers, Constructors
Electrical—Civil—Mechanical
105 So. La Salle Street, Chicago

KERN DODGE
Consulting Engineer
Morris Building, Philadelphia, Pa.

D. C. & WM. B. JACKSON
Engineers
CHICAGO Harris Trust Bldg. BOSTON 248 Boylston St.
Plans, Specifications, Supervision of Construction
General Superintendence and Management
Examinations and Reports
Financial Investigations and Rate Adjustments

WILLIAM A. BAEHR
Consulting Engineer
Gas and Electric Plants
Design, Construction and Operation
Valuations and Reports
People's Gas Building, Chicago

ELECTRICAL TESTING LABORATORIES, Inc.
Electrical and Mechanical Laboratories
Tests of Electrical Machinery, Apparatus and Supplies. Materials of Construction, Coal, Paper, etc. Inspection of Material and Apparatus at Manufactories.
80th St. and East End Ave., New York

THE LIGHT AND DEVELOPMENT CO. OF ST. LOUIS
Operators of Electric, Gas, Water and Street Railway Properties.
Engineers—Experts in Public Utilities Problems.
Suite 750, Railway Exchange Building
St. Louis, Mo.

W. S. BARSTOW & CO.
INCORPORATED
Consulting and Construction Engineers
Public Service Properties
Financed and Managed
50 Pine Street, New York

FARGO ENGINEERING CO.
Jackson, Michigan
HYDRAULIC ENGINEERS
Specialize in the Design of Power Plants and DAMS ON SOIL FOUNDATIONS

McMEEN and MILLER
(Incorporated)
Samuel G. McMeen. Kempster B. Miller.
Leigh S. Keith.
Electrical and Mechanical Engineers
1454 Monadnock Block, Chicago

H. M. BYLLESBY & CO.
INCORPORATED
Chicago, Continental & Commercial Bank Bldg.
New York, Trinity Bldg.
Purchase, Finance, Construct and Operate Electric Light, Gas, Street Railway and Water Power Properties. Examinations and Reports, Utility Securities Bought and Sold.

FORD, BACON & DAVIS
Engineers
115 Broadway
New York
New Orleans San Francisco

DANIEL W. MEAD
F. W. SCHEIDENHELM
Consulting Engineers
Hydraulic and Electric Developments, Water Supply, Reclamation Works and Flood Control.
New York City, Equitable Bldg., 120 Broadway

WALTER G. CLARK
Consulting Engineer
Efficiency Investigations; Technical, Financial, Commercial; Analysis Operating Conditions; Consolidations; Power Contracts; Specification, Test and Inspection of Material.
Dallas, Texas. Los Angeles, Cal.
Singer Building, New York.

FORSTALL and ROBISON
ALFRED E. FORSTALL CHARLES D. ROBISON
Engineers
Design Operation Appraisal
Gas and Electric Properties
84 William Street, New York City

RALPH D. MERSHON
Consulting Electrical and Mechanical Engineer
Estimates, Reports, Plans, Specifications and Supervision of Electric Lighting, Railway and Power Plants, Long Distance Power Transmission.
80 Maiden Lane New York

R. D. COOMBS
CONSULTING STRUCTURAL ENGINEER
TRANSMISSION LINES
DESIGNS & REPORTS
30 CHURCH ST., NEW YORK

FRANK F. FOWLE
Consulting Electrical Engineer
Chicago, Ill.

MOODY ENGINEERING CO.
Engineers
Estimates, Reports, Specifications, Supervision Electric Light and Power Plants, Long Distance Power Transmission Testing and Inspecting.
115 Broadway, New York City

HUGH L. COOPER & CO.
General Hydraulic Engineering, including the design, financing, construction and management of hydro-electric power plants.
101 Park Ave. New York

GRAVES ENGINEERING CO., Inc.
Manage and Construct
PUBLIC UTILITY PROPERTIES
Examinations and Reports. Rate Specialists.
25 Pine Street, New York

W. E. MOORE & COMPANY
Engineers
Reports—Designs—Supervision
Public Service Properties
Power Developments, Distribution and Application
Union Bank Building, Pittsburgh, Pa.

N. J. NEALL
of Boston
Consulting
Electrical Engineer
Lighting Protection

SANDERSON & PORTER
Engineers
Reports, Designs, Construction, Management
Hydro-Electric Developments,
Railway, Light and Power Properties.
Chicago New York San Francisco

PERCY H. THOMAS
Consulting Electrical Engineer
Power Transmission, Design, Advice,
Supervision Lightning Protection
Special Investigations
No. 2 Rector St., New York

NEILER, RICH & CO., Inc.
Consulting and Designing Engineers
Railway Terminals—Industrial Plants
Reports on Engineering Projects
Appraisals and Valuations of Properties
Manhattan Building, Chicago

SARGENT & LUNDY
FREDERICK SARGENT A. D. LUNDY
WM. S. MONROE JAMES LYMAN
Engineers
72 West Adams St.
Chicago, Ill.

UNDERWRITERS' LABORATORIES
W. H. MERRILL, President
Reports on Devices, Systems and Materials having a bearing upon Fire Hazards or Accident Prevention.
Principal Office and Testing Station
207 E. Ohio St., Chicago
New York Office and Testing Station, 135 William Street
Branch Offices Throughout United States and Canada

NORTON BIRD and WHITMAN
William J. Norton Paul P. Bird Ezra B. Whitman
ENGINEERS
Design, Construction, Rate Surveys, Preparation of Rate Schedules, Appraisals, Examinations, Reports, Special Investigations of Public Utility Properties
111 West Monroe St., Chicago, Illinois
Munsey Building, Baltimore, Maryland.

SCOFIELD ENGINEERING CO.
Consulting Engineers
Power Stations Gas Works
Hydraulic Developments Electric Railway
Philadelphia

THE J. G. WHITE COMPANIES
Engineers—Contractors
Financiers — Operators
43 Exchange Place, New York
Chicago San Francisco

CHARLES L. PILLSBURY
Electrical and Mechanical
Consulting Engineer
Consulting Engineer to Minnesota
State Board of Control
Suite 805-811, Metropolitan Life Building
Minneapolis, Minn.

STONE & WEBSTER
ENGINEERING CORPORATION
Constructing Engineers
New York Boston Chicago

GARDNER S. WILLIAMS
Consulting Engineer
Water Power and Electrical Developments, Reports, Designs, Specifications, Surveys, Superintendence, Estimates, Appraisals.
Cornwell Building, Ann Arbor, Mich.
Corn Exchange Bank Bldg., Chicago, Ill.

W. EDGAR REED
Consulting Engineer
Designer of Electrical Machinery.
Estimates, Reports, Plans, Specifications and Supervision of Lighting, Railway, Industrial and power Installations.
Frick Annex Bldg., Pittsburgh, Pa.

JOHN BELLAMY TAYLOR
Consulting Engineer
SCHENECTADY, N. Y. NEW YORK CITY
Office and Laboratory 100 Broadway
23 Lowell Road. Tel. 2791 Tel. Rector 4320
Technical Investigations, Tests, Inspections.
Telephone and Telegraph Relations to Electric Light and Power Systems.
Induction and Earth Current Problems.
Electrical Transmission, Transformation and Distribution.

WOODMANSEE & DAVIDSON, Inc.
Engineers
Continental & Commercial Bank Bldg.,
Chicago, Ill.

Copper Wire for Sale
Thirty-six miles of new No. 4 copper wire for sale. Salmon River Power and Light Co., Salmon, Idaho.

"We had numerous inquiries—
Sold the wire in about 10 days"
Another instance of quick action through the
SEARCHLIGHT SECTION
of the
ELECTRICAL WORLD

Searchlight Advertisements DO PULL!

Card Index ELECTRICAL WORLD, NEW YORK, JUNE 17, 1916. Vol. 67

Three-Core Cables	1394
Dallas Negotiations Fail	1396
Silvanus Thompson Dead	1397
Water-Power Legislation	1398
Leaders in the Electrical Art and Industry	1399
Concrete Cells for Circuit Breakers and Busbars	1402
Corona as a Standard for Measuring High Voltage	1405
An Aanlysis of Vapor-Rectifer Losses	1409
Testing and Filtering of Transformer Oil	1413
Electric Oscillatory Prenomena of Speaking Arc	1415
Opportunities for Young Electrical Engineers—IV. In Research and Testing. By Preston S. Millar	1416
Operating Expenses for Massachusetts Steam Stations	1418
How the Smokestack of a Hotel Plant Was Made Inconspicuous	1418
Operating Costs for Several Diesel Engine Installations	1419
Arrangements to Operate an Exhaust Fan for Emergency Service	1419
A Disconnecting Switch and Fuse Box for 6600-Volt Distribution Lines	1420
Causes of Telephone "Noise" and Its Elimination	1420
Graphic Aid in Figuring Power Bills	1422
Developing Unwired Communities with the Help of Journeymen Contractors	1423
The Electrically Equipped Office Exhibit and Its Message to the Housewife	1423
How a Substantial Revenue Is Obtained from Breakdown Service Customers at Clinton, Iowa	1425

ENGINEERS *and* CONSTRUCTORS
A purely engineering organization with nothing to sell except our services
W·C·K

Engineering Co-operation

The wide scope of W. C. K's. activities makes their organization available for every kind of engineering and construction work.

Westinghouse Church Kerr & Co.
ENGINEERS *and* CONSTRUCTORS
37 Wall Street, New York
CHICAGO, Conway Bldg. SAN FRANCISCO, Pacific Bldg.

SEARCHLIGHT SECTION

GREGORY ELECTRIC CO.
16TH AND LINCOLN ST
CHICAGO, ILLINOIS

* SECOND HAND * ELECTRICAL MACHINERY

Send for our "MONTHLY BARGAIN SHEET," showing complete list with net prices.

For Sale

3-phase—60-Cycle

	K.V.A.		Speed
1	5	Roth, single - phase, 110 volt	1800
1	30	Fairbanks - Morse, 2300 v.	1200
1	50	Ft. Wayne, 3-phase, 60 cy., 2300 v., direct - con. Erie City engine	300
1	75	Fairbanks - Morse, 2300 v.	1200
1	75	Gen. Elec. ATB, revolving field, 2300 v.	900
1	100	Westinghouse, three-phase, revolving field, 2300 volts	900
1	100	Westinghouse, revolving field, three-phase, 240 volts	900
1	100	Gen. Elec., single phase, rev. field, 2300 volt, direct-connected, Ideal engine	277
1	100	Westinghouse, single phase, 60 cycles, 6600 volt, generator direct - connected to 3-phase, 25 cy., 440 volt motor	720
1	110	Westinghouse, 3-phase, rev. field, 250 v.	600
3	115	Allis-Chalmers, 3-phase, rev. field, 2300 v.	900
1	120	Westinghouse, 3-phase, rev. armature, 2200 volts	720
1	125	Gen. Elec., type ATB, 3-phase, rev. field, 2300 volt, direct connected Ideal Engine	277
1	125	Gen. Electric, type ATB, 3-phase, rev. field, 240 or 480 volt, direct-connected tandem-compound Ideal	277
1	200	Gen. Elec., type ATB, form D, 3-phase, rev. field, 2300 v.	600
1	250	Electric Mach. Co., 3-phase, rev. field, 2300 volts	720

3 phase 25 Cycle

	K.V.A.		Speed
1	500	Westinghouse, rev. field, 440 v.	300

220 to 250 Volt D. C. Generators

	KW.		Speed
1	18	Northern, MP.	950
1	25	Gen. Elec., MP.	1050
1	35	Gen. Elec., Curtis non-condensing turbine (125 lbs. steam)	3600
1	50	Ft. Wayne, to Buffalo Forge vertical engine	275
1	75	Northern, to comp. Ideal engine.	275
1	75	Gen. Elec., to Erie-Ball	235
2	80	Jenny, 6-pole	600
1	100	Milwaukee, to Buckeye engine	250
3	125	Gen. Elec., 3-wire, Turbo-generators	2400
1	150	Western Elec.	575
1	150	Triumph	500
1	150	Willey, to 4-valve Atlas engine.	225

110 to 125 Volt D. C. Generators

	KW.		Speed
1	15	Watson	1200
1	20	Commercial	1280
1	20	Fairbanks-Morse	1200
1	22½	Northern	1050
1	22½	Westinghouse	975
2	15	Allis-Chalmers, to single-stage DeLaval type TD steam-turbine, for 125 to 200 lbs. steam-pressure.	2000
1	25	Gen. Elec.	1100
1	25	Gen. Elec., to 3-cylinder Westinghouse vertical gas or gasoline engine.	350
1	30	Western Electric, to Harrisburg-Fleming engine	300
1	30	Crocker-Wheeler	825
1	40	Westinghouse	550
1	45	Gen. Elec.	975
1	55	Sprague	625
1	56¼	Westinghouse	525
1	70	Ft. Wayne	900
1	75	National	750
1	75	Westinghouse	750
1	80	Triumph	800
1	85	Crocker-Wheeler, to tandem-comp. Ideal engine	250
1	100	Milwaukee	575
2	100	Gen. Elec., to Harrisburg - Fleming crank engines.	260
1	125	Milwaukee	450

Electrical Machinery for Immediate Delivery

1000 kw. Westinghouse-Parsons Turbo generator set, 3 phase, 60 cycle, 4000 volts.
350 kw. Bullock generator, 3 phase, 60 cycle, 2300 volt, direct connected to Leffel Turbine for 90′ head.
250 kw. General Electric generator, 3 phase, 60 cycle, 2300 volt, 450 r.p.m.
200 kw. Westinghouse generator, 3 phase, 60 cycle, 440 volt, 900 r.p.m.
150 kw. General Electric generator, 3 phase, 60 cycle, 2300 volt, 600 r.p.m.
150 kva. Crocker-Wheeler generator, 3 phase, 60 cycle, 2300 volt, 600 r.p.m.
50 kw. General Electric generator, 3 phase, 60 cycle, 2300 volt, 1200 r.p.m.
300 h.p. Westinghouse Synchronous motor, 3 phase, 60 cycle, 450 volt, 450 r.p.m.
150 h.p. Three Rivers motor, 3 phase, 60 cycle, 440 volt, 600 r.p.m.
150 h.p. General Electric motor, 3 phase, 60 cycle, 440 volt, 600 r.p.m.
100 h.p. General Electric motor, 3 phase, 60 cycle, 440 volt, 600 r.p.m.

Our stock also comprises a large list of boilers, engines, water wheels, pumps and mining and milling machinery. Send for complete stock list.

The Morse Bros. Machinery and Supply Co., Denver, Colorado

BOILERS

(Watertube.) (Insurance certificate 150 lbs. pressure.)

Ten 250 H.P. Babcock & Wilcox, $11,250.
One 425 H.P. Babcock & Wilcox, $1900.
Two 350 H.P. Heine, $3000.
Three 300 H.P. Babcock & Wilcox, $4000.
One 200 H.P. Heine, $800.

Power Machinery Exchange, Inc.
14 Morris St. **Jersey City, N. J.**

Send for latest "Bargain List" of boilers, engines, generating units, motors, machine tools, etc.

FOR SALE

2—300 KW (80% P.F.) 3600 R.P.M., 240 volt, 2 phase, 60 cycle, Allis-Chalmers **steam turbo generator.**

2—Allis-Chalmers type "C" turbo **jet condenser,** 28″ vacuum.

1—Allis-Chalmers ABC, 7½ KW engine driven **exciter set.**

1—Allis-Chalmers 15 KW, induction motor driven **exciter set.**

Piping, pumps, etc., to make necessary installation.

The above apparatus can be secured at once.

BOX 2300, ELEC. WORLD

IN STOCK

1—General Electric, 105 kw., type ATB, class 28-105-257, form E, 3 phase, 60 cycle, 2300 volts, 26.5 amperes, 257 r.p.m., revolving field generator, direct connected to a 150 hp., 14 x 16 Ball automatic engine on sub-base, with force feed lubrication, belted exciter and suitable switchboard.
1—25 hp., type CCL, 3 phase, 60 cycle, 1135 r.p.m., 220 volts, Westinghouse motor, with pulley, base and starting box.
Also engines, boilers and power plant machinery of any kind.

The Randle Machinery Co., 1822 Powers St. **Cincinnati, Ohio**

FOR SALE

One 25 HP. Fairbanks-Morse **Crude Oil Engine** belted to a 15 KW. 220 volt D.C. **Generator.**
One Marble **Switchboard,** 220 volt **Watt Meters,** 220 volt **Fans,** and **Irons.**
Oil **Tank** and piping for engine.

MISSOURI GAS & ELECTRIC SERVICE CO.
RICHMOND, MISSOURI

SEARCHLIGHT SECTION

THREE 600 KVA. TRANSFORMERS—60 CYCLE

THREE GENERAL ELECTRIC TRANSFORMERS, TYPE OC-60-600 KVA., SHELLTYPE, OIL COOLED, 6600-2300 VOLTS PRIMARY, 440 VOLTS SECONDARY.

Send for Our Catalogue of Steam and Electrical Equipment

MacGovern and Company, Inc.

FRANK MACGOVERN, Pres. & Gen. Mgr.

114 Liberty St., New York City

ARCHER & BALDWIN

114-118 Liberty Street New York City

TELEPHONE 4337-4338 RECTOR

A. C. TURBINES

1—1000 K.W., 1250 K.V.A., at 80% P. F., General Electric, 2300 V. horizontal turbo generator, 3 ph., 60 cy., Type ATB., 3600 R.P.M.
1—500 K.W. General Electric Curtis Vertical Steam Turbine, 3 ph., 60 cy., 2300 V., 1800 R.P.M.

BELTED ALTERNATING CURRENT DYNAMOS

2—500 K.V.A., G.E., Type ATB, 3 ph., 60 cy., 2300 volt, 360 R.P.M.
1—250 K.W., G.E., Type ATB., 3 ph., 60 cy., 6600 volt, 450 R.P.M.
2—100 K.W. Allis-Chalmers, 2 ph., 60 cy., 2300 volt, 900 R.P.M.
1—100 K.W. Westinghouse, 2 ph., 60 cy., 2400 volt, 900 R.P.M.
1—50 K.V.A. Crocker Wheeler, 2 ph., 60 cy., 2300 volt, 1200 R.P.M.

DIRECT CONNECTED DIRECT CURRENT UNITS

1—600 K.W. Gen. Elec., 250 v., 120 R.P.M., direct ctd., to 22 and 44 x 36" McI. & S. cross compound, four valve, vert. engine.
1—300 K.W. Crocker Wheeler 250 v., 8 pole, 150 R.P.M., direct ctd. to 20 & 41 x 18" Ball & Wood vert. cross compound engine.
1—250 K.W., three wire unit consisting of 2—125 K.W. Crocker Wheeler Type CCD., 8 pole, 250 R.P.M., direct ctd. to 15½ & 31 x 16" Ball & Wood, centre crank, tandem compound engine.
1—100 K.W. Westgh., 250 V., 6 pole, 257 R.P.M., direct ctd. to 15 x 16" Harrisburg side crank piston valve engine.
1—80 K.W. Gen. Elec., 6 pole, 270 R.P.M., direct ctd. to 13 x 14" Harrisburg side crank piston valve engine.
1—75 K.W. Westgh. 250 V., 6 pole, 290 R.P.M., direct ctd. to 12 & 20 x 12" Westgh. engine.
1—75 K.W. Gen. Elec., Form L., 6 pole, 115/120 V., 270 R.P.M., direct ctd. to Straight Line engine.
1—75 K.W. Gen. Elec., Form L., 240 V., 6 pole, 270 R.P.M., direct ctd. to Watertown horiz., right hand engine 14 x 15".

TRANSFORMERS

60 Cycle and 25 Cycle Transformers, all sizes.

HAROLD R. WILSON MACHINERY CO.

ELECTRIC & STEAM MACHINERY SECOND HAND
Federal Reserve Bank Bldg., ST. LOUIS, MO.
DIRECT CONNECTED A.C. UNITS (60 CYCLES)

K.W.	Make	Volts	Ph.		Engine Description
	1200	G. E.	480	3	to 28&46x36 Erie City 4 Valve
3—	1500	Allis	2300	3	to 1800 R.P.M. Allis Hor. Turbines
	1200	Westge.	2300	3	to 28&56x48 Rice & Sargent C.C. Cor.
4—	1000	W'ge.&G.E.	2300	2or3	to Low, High & Mixed Pressure Turbs.
	800	All.-Ch.	480-220	3	to 26&44x48 Allis Corliss H. C. C.
	500	Allis	2300	3	to 20&32x42 Allis C. C. Corliss
3—	500	Stanley	2300	2or3	to 18&36x48 Allis C. C. Corliss
	500	G. E.	480	3	to 18&35x30 Erie City C. C. Corliss
	450	Westge.	440	3	to 32x27 Ball & Wood 4 Valve
2—	400	G. E.	2300	3	to Comp. Buckeye Engine
	375	G. E.	2300	3	to 18&32x24 Russell Tand. C.
2—	300	G. E.	any	3	to 1 Simple 1 to comp. Harrisburg
	250	Westge.	2200	2or3	to 16&30x30 Pa. Corliss H. C. C.
	240	Ft. Wayne	440	3	to Buckeye L. H., H. D.
	200	Westge.	2300	2or3	to De Laval Hor. 300 H.P. St. Turb.
	150	Allis	220-440	3	to 16x30 Allis H. D. H. Corliss
	125	Westge.	any	3	to 3600 R.P.M. Parsons St. Turbine
	100	G. E.	any	3	to Curtis St. Turb. Non-Cond. 3600 R.

Other Sizes—Also A.C. & D.C. Belted Dynamos, Motors, ENGINES—BOILERS—ROTARIES—ELECTRIC CARS, Etc. We probably have just what you require—Try us.

Electrical Equipment For Sale

1 Bullock Electric Mfg. Co. 2 phase, 60 Cycle, 2200 V. 150 K.V.A., 900 R.P.M. Alternator, complete with belted exciter, pulleys and slide rails.

1 Control Panel for above, with exciter switch and rheostat, primary switches, instruments and transformers, mounted on white marble slab.

1 Distributing Panel, of white marble, on which are mounted three D.P.D.T. 2200 V. Knife switches, with necessary instruments and transformers.

3 General Electric Type C.R. Potential Regulators, 60 Cycle, 2200 V., 5.5 K.W.

1 Canadian Westinghouse 2200 to 105/52.5 V. Transformer, 75 K.W. single phase, 60 Cycles.

—Above equipment installed as an auxiliary lighting plant; has been used very little and is in first-class condition.

1 Canadian General Electric 72 K.W., 2400 V., 1000 R.P.M., 2 phase, 56 Cycle Alternator, S.K.C. system, complete with belted exciter, slide rails and pulleys.

1 Generator Panel for above, with primary switches, exciter switches and rheostat, instruments and transformers mounted on white marble panel.

—In good condition; fine machine for a small plant.

48 Adams-Bagnall A.C. Multiple, 110 V., 6 ampere, Regenerative Flaming Arc Lamps.

1 50 K.W. Single phase 11,000 V., 60 cycle, Westinghouse Generator, complete with rheostat, sliding base and series transformer.

1 2 K.W. Exciter for above complete with sliding base and rheostat.

1 22,000 V., automatic oil switch.

Algoma Steel Corp'n Ltd.

Sault Ste. Marie, Ont.

ALTERNATING CURRENT MOTORS
For immediate delivery

2—50 hp. General Electric type I form K 514 speed 60 cycle 220 volts.
2—50 hp. Westinghouse slip ring 1120 speed 60 cycle 220 or 440 volts.
1—65 General Electric 480 speed 40 cycle form L.
Other sizes in stock.
Deming deep well pump—Gould pumps.

R. SCHEINERT CO. 125 N. 3rd St., Phila.

FOR SALE

One Fairbanks-Morse A.C. 40 KVA., 2300 volt, *Generator* and *Exciter*. Excellent condition.
One Warren Electric 60 KVA., 1100 volt, 133 cy., *Generator* and *Exciter*,
One Eddy D.C. 20 KW., 250 volt *Generator*.
One G.E. 100 KW., Single Phase *Generator*.
All the above is second-hand apparatus, but in excellent operating condition and for sale cheap.

R. T. PRICE, Pur. Agent P. O. Box 127 Abilene, Texas

SEARCHLIGHT SECTION

The following is for sale at the Municipal Electric Lighting and Power Plant, Richmond, Ind.

Address all inquiries to C. A. Kleinknecht, Superintendent

1—Kennicott Water Softener, 5000 Gallons per hour, 12' x 29'.
1—125' x 6' Smoke Stack with Guys, 50 Feet ¼" Iron and 75 Feet 3/16" Iron.
1—125' x 6' Smoke Stack with Guys (Old Stack).
1—75' x 5' Smoke Stack with Guys (3/16" Iron at Bottom and ⅛" Iron at Top).
2—Tandem Compound Buckeye Engines (1 Right and 1 Left), 14½ x 25 x 30, 150 R.P.M., Fly Wheels, 34" Face, 12' Dia.
1—Cross Compound Buckeye Engine (15¼ x 30½ x 30), 150 R.P.M., Fly Wheel 48" Face, 12' Dia.
2—General Electric 150 K.W., 2300 Volt, 60 Cycle, 3 Phase Belt Driven Alternators, 600 R.P.M., 150 K.V.A., Form "D" with Exciters, G.E. Type C.Q. 10, 5 K.W., 60 Volt, 83½ Amperes, 625 R.P.M., with Switch Board Equipment. Alternator No. 71208 Type A.T.B., Class 12. Alternator No. 66743, Type A.T.B., Class 12. Exciters Shunt Wound, Form A 10/41. No. 153081 and No. 158340.
2—General Electric 100 K.W., 550 Volt, D.C. Generators, 650 R.P.M., 180 Amperes, with Rheostats. No. 938 and No. 930.
2—24" Two Ply Belts, 90 Feet Long. (Leather).
1—16" Two Ply Belt, 100 Feet Long. (Leather).
1—30" Three Ply Belt, 87 Feet Long. (Leather).
1—14 x 22 x 24 Deane of Holyoke Jet Condenser. No. 76362.
1—Allis-Chalmers Motor Generator Set, Motor is 2300 Volt, 60 Cycle, 3 Phase, 15 Amperes, 60 K.W., No. 10930, 900 R.P.M., Synchrist Direct connected to 60 K.W., 550 Volt, D.C. Generator, No. 10929, 900 R.P.M., also 1 70 Volt D.C. Exciter Generator direct connected with Rheostat and Switch Board Equipment. No. 10931, 20 Ampere, 900 R.P.M.
1—Westinghouse 400 K.V.A., 2300 Volt, 60 Cycle, 3 Phase, 3600 R.P.M., Turbo Generator, 150 Lbs. Steam Condensing with Switch Board Equipment. Serial No. 203588.
1—Worthington 2000 Foot Surface Condenser with Dry Vacuum Pump, No. 199864B, No. 357871W, 6 x 12 x 6, Engine driven Circulating Pump No. 5932, Valute 8". Motor driven Hot Well Pump No. 5913, driven by Westinghouse 124/10 Amp. Motor, 5 H.P., 220 V., 1½", 60 Cycle, 3 Phase, 1735 R.P.M. No. 1579523.
1—10 x 6 x 12 Marsh Center Packed Plunger Boiler Feed Pump.
1—Hoppes Feed Water Heater.
1—350 H.P. Babcock & Wilcox Boiler, 160 Lbs. Steam Pressure, 168—4" Tubes 18 Ft. Long, 14 Wide, 12 High, 2—42" Drums, 7/16" Thick, 20' 4" Long. Open Hearth Steel 56,000 Lbs.
1—300 H.P. Babcock & Wilcox Boiler, 160 Lbs. Steam Pressure, 168—4" Tubes 14 Ft. Long, 14 Wide, 12 High, 2—42" Drums, 7/16" thick, 16' 5½" Long. Open Hearth Steel 56,000 Lbs. Job No. 2866, 1898.
2—Munoz 264 H.P. Boilers.
1—General Electric 35 K.W., 125 Volt, D.C. 3600 R.P.M., 200 Lbs. Steam Pressure, non-condensing Turbo Generator Set No. 386611, Type No. 00.
1—15 K.W. Engine Driven D.C., 125 Volt, Generator Set, Alfree Engine 7 x 8, No. 696, 125 Volt, G.E. D.C. Generator, 400 R.P.M., 80 Lbs. Steam No. 54256, Spec. 18386, 120 Ampere.

FOR SALE

One 1500 Kw Turbo-Generating Plant, consisting of:

One Adamson Rateau Mixed Pressure Steam Turbine, capacity 1500 Kw. at 1500 R.P.M., complete with oil relay governor and automatic control gear.

Alternator of Swedish General Electric Co.'s manufacture, Voltage 2200, 25 cycle, 3 phase, 80% Power Factor.

Condenser mfd. by Mirrless Watson Co., Glasgow, Barometric jet type, capacity 53,000 lbs. steam per hour and maintaining a vacuum of 27.75 and Barometer at 30 in. and water at 55° Fahr.

Switchboard consists of one Generating Panel and one Exciter Panel, each complete with all instruments, etc., including automatic or hand voltage regulator.

Heat Accumulator of Rateau type, has a regenerating action of 53,000 lbs. of steam per hour, capable of bridging stops of 30 seconds duration, complete with valves, regulators, separators, etc. Detailed specifications and price on application to

Algoma Steel Corporation, Limited
Sault Ste. Marie, Ontario

MOTORS

1500 Other Bargains All Guaranteed

DC Motors & Generators			AC Motors—60 cycle			
HP. Make	Volts	Speed	HP. Make	PH.	Volts	Speed
10 G. E.	230	460/920	6- 5 WSGH.	2	220	1800
3-10 C & C	230	500	5 Bell	1	110/220	1800
10 Standard	230	1225	8- 5 G. E.	1	110/220	1800
15 G. E.	500	750	2- 5 Wgr.	1	220	1700
15 Diehl	230	675	3- 5 Century	1	220	1700
2-15 Standard	230	1200	7½ Wgr.	1	220	1750
15 Milwaukee	110	750	10 Wgr.	1	220	1700
17½ W. E.	115	650	12 G. E. 40 cy.	2	220	1200
20 C & C	500	1120	4-15 G. E.	2	220	1200
20 Wood	220	1600	15 Watson	3	220	1200
2-20 W. E.	220	800	15 Wsgh.	2	220	1120
2-35 Sprague	230	800	4-20 G. E.	2	220	1200
40 G. E.	220	915	25 WSGH.	2	220	850
60 G. E.	240	975	25 WSGH.	3	550	675
125 Otis	240	450	30 WSGH.	2	220	1120
2-2.2 KW. G. E.	50	515	20 FBKSM.	3	220	1150
14 KW. G. E.	150	1500	40 WGR.	2	220/440	1200
80 KW. WSGH.	220	700	2-50 WSGH.	2	200	850

Nathan Klein & Co., Inc., 208 Centre St., New York

FOR SALE

1—S. Howes Oat Clipper No. 32-41511..... $250
1—500 bu. Jones Hopper Scale..... 50
1—Twin City Cross Compound engine, 10 x 18 x 30. 1500
1—Platt Iron Works Surface Condensor, 9½ x 10 x 12 x 12 1500
1—Platt Iron Works Boiler Feed Duplex Pump, 6 x 4 x 6 100
1—Tate Jones Double Fuel Oil Pump..... 100
2—Bonus Kennicott 110 hp. Water Tube Boilers, 45 4" tubes—insured and inspected 150-lbs. pressure, practically as good as new..... 2000

All the above is in working order and may be seen in working order 24 hours each day. We will be glad to show it.

PLAINVILLE MILL & ELEVATOR CO.
Plainville, Kansas

SEARCHLIGHT SECTION

Get your Wants into the Searchlight

ADVERTISING RATES

Under "Positions Wanted," including Salesmen looking for new connections, Evening Work Wanted, Side Line Wanted, etc., undisplayed advertisements cost **two cents a word,** minimum charge 50 cents an insertion, **payable in advance.**

Under "Positions Vacant," including Agents and Agencies Wanted, Representatives Wanted, Salesmen Wanted, Partners Wanted, Desk Room Wanted or For Rent, Business Opportunities, Employment Agencies, and Miscellaneous For Sale, For Rent, and Want ads; also Auction Notices, Receivers' Sales, Machinery and Plants For Sale or Wanted (with one line of display heading), undisplayed advertisements cost **three cents a word,** minimum charge $1.50 an insertion.

If replies are in care of any of our offices, allow five words for the address.

All advertisements for bids (Proposals) cost $2.40 an inch.

ADVERTISEMENTS IN DISPLAY TYPE

cost as follows for single insertions:

⅛ p. (1½x3⅝ ins.)	$6.25	1 in. (1x2⅝ ins.)	$4.00
¼ p. (2⅝x3⅝ ins.)	12.50	4 inches (4x2⅝ ins.)	15.20
½ p. (5x3⅝ or 2⅝x7 ins.)	25.00	8 inches (8x2⅝ ins.)	29.20
½ p. (10¼x3⅝ or 5x7 ins.)	50.00	15 inches	52.50
1 page (10¼x7 ins.) 30 inches	$100.00		

For space to be used within one year, to be divided to suit requirements of advertiser, provided some space is used at least once a month following first insertion:

3 pages	$88 a page	18 pages	$68 a page
6 pages	80 a page	26 pages	64 a page
12 pages	72 a page	52 pages	60 a page

In replying to advertisements, do NOT enclose original testimonials, drawings or photographs that you may want returned. Advertisements for men often produce several hundred applications and no employer can be expected to read all of these carefully and return the papers or applications of those in which he is not interested. State your experience and qualifications in as concise and neat a manner as possible and enclose COPIES of your testimonials.

When advertising machinery, use your own name and address—or a local address of some kind—so that the readers can wire direct and get quick replies. We advise also that you state in your advertisement the present location of plant that is offered for sale, or point of delivery provided you are in the market for equipment.

FOR SALE

Plants for Sale

We have under contract for sale, electric, gas and water plants, singly and in groups, some in combination. If you wish to buy, write in what State you prefer the properties. We buy and sell utilities. G. Y. Bonus, 1649 Marquette Bldg., Chicago, Ill.

Equipment for Sale

150 kw., D.C. Westinghouse generator 250-125 volts, 600 A., 210 r.p.m. with Ball 18 x 18 horizontal steam engine; 100 kw. Westinghouse D.C. generator 250-125 volts, 400 A., 250 r.p.m. with Ball 16 x 16 horizontal steam engine. Both engines side crank auto high speed with flywheel governor. Switchboard accessories included. All in good condition. The University of Chicago, 134 S. La Salle St., Chicago, Ill.

1 G. E. Mercury Arc Rectifier

Type M.S. Volts, D.C. 10/120; A.C., 110/220, 60 cycles, 30 amps. capacity, two tubes. In first class shape; used only three months. Address inquiries: Namco, Windsor, Vt. Attention Mr. Robinson.

For Sale—250 Volts D.C. Units

1—1200 kw. Western Electric to Rice & Sargeant Corliss engine; 1—1000 kw. Western Electric to Filer-Stowell Corliss engine. The above complete with switchboard, condenser equipment and accessories. Can be inspected on foundation at mammoth plant of the Western Electric Co., Chicago, Ill. For immediate shipment apply owners, George Sachsenmaier & Co., 145 N. Third St., Philadelphia, or Arthur Jones Electric Co., 55 E. 28th St., Chicago.

Transformers for Sale

Ten circulating oil cooled G. E. transformers, 1667 kva., 60 cycle, single phase, high voltage 30,000/60,000 volts, low voltage 12,000 volts. These transformers have never been in service. Immediate shipment. Complete specifications on request. Box 2262, Elec. World, Real Estate Trust Bldg., Philadelphia, Pa.

Meters for Sale Cheap

A number of Thompson recording watt meters, 100 to 110 volts, 5 amperes and up. Meters equipped with adjustable shunt and guaranteed to be in first class condition. Box 2292, Elec. World, 1570 Old Colony Bldg., Chicago, Ill.

FOR SALE

Engine and Generator for Sale

For immediate delivery. Ball Erie tandem compound engine, 240 hp., 225 r.p.m. Fort Wayne 3 phase, 60 cycle, 150 kw., 600 r.p.m., 2300 v., generator, exciter, switchboard, belts, etc. A complete unit in excellent condition. Reason for selling, has been replaced with larger equipment. Morris & Somerset Electric Company, 38 Washington St., Morristown, N. J.

Boiler and Turbine for Sale

For immediate shipment, one 425 hp., B. & W., A. & T. type water tube boiler, tested and insured for 150 lb. pressure. Boiler in excellent condition. One 300 hp. De Laval turbine direct connected to two 100 kw. Westinghouse generators, E.M.F., 2200 volts, 21.7 amperes per terminal, two phase, alternating, 7200, speed 900. Also 200 hp. Imperial engine, 14 in. x 20 in. x 16 in. stroke. The reason for selling on account of purchasing current from outside sources. Address Corning Light & Power Corporation, Corning, N. Y.

Generators for Sale

2—1200 kw., 25 cycles, 6600 volts, 3 phase General Electric alternators with 30 in. x 50 in. x 60 in. Allis-Corliss horizontal cross-compound engines; 1—800 kw., 600 volt direct current generator with 32 in. x 60 in. simple Allis-Corliss engine. United Railways Company, 3869 Park Ave., St. Louis, Mo.

Diesel Engine for Sale

By Atlantic Light & Power Company, Coeymans, N. Y., a 3-cylinder, 120 hp. Busch-Sulzer Bros. Diesel engine in perfect condition for use. Critical inspection invited. No brokers.

Generating Apparatus for Sale

All the generating apparatus in its Eleventh St. station, as follows: Boiler, stack, breeching, piping, heater, pump, engine, tightener, generator, exciter, and generator switchboard panel. Description of the same will be mailed on application. Bay City Electric Light Department, Bay City, Mich.

Gas Producer Power Unit

A first class 50 kw., 125 volt, 400 amp. D.C. Crocker-Wheeler generator, direct connected to a 65 hp. Nash gas engine, operated by a 100 hp. Smith gas producer, in good running condition, for sale cheap. Universal Oxygen Company, Sheboygan, Wisconsin.

FOR SALE

Harrisburg-Westinghouse A.C. Unit

1—17 x 15 Harrisburg side crank engine, connected to 145 kw. 2 phase, 60 cycle, 440 volt alternating current Westinghouse revolving field generator, with exciter and switchboard, seen in operation. Immediate delivery. H. P. Brearley, 90 West St., New York.

Oil Engine for Sale

1—20 hp. Fairbanks-Morse Type Y crude oil engine. Never in use. Also one 4 kw., 60 volt D.C. generator. Address P. O. Box 616, Baton Rouge, La.

Generator Set for Sale

A 100-kw. Gen. Electric A.C., three-phase, 60-cycle, 2300-volt turbo-generator set, $2,000.00. Hoshall Machinery Co., Memphis, Tenn.

Desk Fans for Sale

We have several 133 cycle, 110 volt, desk fans for sale at a bargain, in excellent condition, used but little; oscillating and non-oscillating and bracket types. Address Iowa Falls Electric Co., Iowa Falls, Iowa.

For Sale Cheap

One 75 kva. Westinghouse revolving field generator, 25 cycles, three phase, 300 revolutions, direct connected to 12 x 12 Ames automatic engine, complete with exciter, switchboard and feed water heater; also motors and transformers. Address Hoffman, 280 Carolina St., Buffalo, N. Y.

Interest in Light and Power Plant

Controlling interest in one of the best one-man light and power propositions in the State. $2,300 will buy control and $5,000 will double revenue. Terms if necessary. Box 2357, Elec. World, 1570 Old Colony Bldg., Chicago, Ill.

Motors for Sale

2 General Electric 20 HP., 1040 R.P.M., 230 V.—shunt wound direct current motors, type C.E. form A without bases, pulleys or starting rheostats. Both in good condition. Muncie Electric Light Company, Muncie, Indiana.

Light Plant for Sale

Electric light plant in growing Western town. Box 2068, Elec. World, 1570 Old Colony Bldg., Chicago, Ill.

SEARCHLIGHT SECTION

FOR SALE

Buckeye Engine for Sale

Eighty hp. Good condition. Using outside power, hence reason for disposing of same. Write for particulars and price. New Standard Adding Machine Company, St. Louis, Mo.

MISCELLANEOUS WANTS

Light Plant Wanted

Will purchase electric light in town of 2,000 to 3,000 population. Location, Indiana or Ohio preferred or would make a loan. Robert S. Ashe, Richmond, Ind.

D. C. Instruments Wanted

One 10 ampere, 32 volt d.c. watt-hour meter. Also one 0 to 25 ampere, d.c. Bristol recording ammeter. Must be in first class condition and price right. Box 2349, Elec. World, 1570 Old Colony Bldg., Chicago, Ill.

BUSINESS OPPORTUNITIES

Business for Sale

Electric supply and contracting business in city of 10,000 population. Right price if sold at once. Box 2336, Elec. World, 1570 Old Colony Bldg., Chicago, Ill.

American Firm Locating in Canada

Advertiser having very valuable Canadian charter, together with municipal agreements and $50,000 stock subscribed, wants to get in touch with electrical manufacturing company intending to locate and manufacture in Canada. Principals only. Box 2346, Elec. World.

PROPOSALS

TREASURY DEPARTMENT, Supervising Architect's Office, Washington, D. C., June 5, 1916.—Sealed proposals will be opened in this office at 3 p. m., June 28, 1916, for furnishing and installing lighting fixtures in the United States post office, custom house, and court house at Hilo, Hawaii, in accordance with drawings and specifications, copies of which may be had at this office. Proposals are desired only from those qualified to produce work of the highest grade, both artistically and mechanically, and the right is reserved to refuse to send the drawings and specifications to or to receive proposals from anyone who, in the opinion of the Supervising Architect, is not so qualified. JAMES A. WETMORE, Acting Supervising Architect.

TREASURY DEPARTMENT, Supervising Architect's Office, Washington, D. C., June 5, 1916.—Sealed proposals will be opened in this office at 3 p. m., July 5, 1916, for a new boiler, etc., in the United States post office, at Spartanburg, S. C., in accordance with the drawing and specification, copies of which may be had at this office or at the office of the custodian at Spartanburg, S. C., in the discretion of the Supervising Architect. JAMES A. WETMORE, Acting Supervising Architect.

TREASURY DEPARTMENT, SUPERVISing Architect's Office, Washington, D. C., June 12, 1916.—Sealed proposals will be opened in this office at 3 p. m., July 7, 1916, for a new boiler, etc., in the United States court house and post office at Fort Scott, Kansas, in accordance with the drawings and specification, copies of which may be had at this office or at the office of the custodian at Fort Scott, Kan., in the discretion of the Supervising Architect. JAMES A. WETMORE, Acting Supervising Architect.

PROPOSALS

Bids open July 10, 1916.

ORNAMENTAL LIGHTING SYSTEM

JERSEYVILLE, ILL.

Bids will be received up to and including July 10, 1916, by Will Hall, City Clerk, Jerseyville, Ill., for an ornamental lighting system, continuance of seven blocks.

Plans and specifications are ready to be submitted to prospective bidders.

WILL HALL,
City Clerk.

POSITIONS WANTED

ALL around construction, maintenance and operating man who is a practical electrician and machinist with moderate technical training, desires position in charge of station or similar position requiring services of sober and reliable man with clean record. Box 2312, Elec. World, 1570 Old Colony Bldg., Chicago, Ill.

AMERICAN, broad experience in electrical and mechanical work, desires to connect with proposition where honesty, hard work and administrative ability will be appreciated. Will go anywhere; speak Spanish and have best of references. Box 2283, Elec. World.

BOOKKEEPER—A young man, experienced in bookkeeping, wants a position as head bookkeeper with an electric, gas or construction company. Best of references. Now employed. Box 2348, Elec. World, 1570 Old Colony Bldg., Chicago, Ill.

CENTRAL station sign development has been my specialty for ten years. Have manufactured them and also managed sign selling campaigns for the biggest lighting companies. Will consider proposition in commercial department where there is opportunity for big results in this field. Benjamin Wall, Allendale, N. J. (Formerly electrical sign expert for New York Edison Co. and general manager Metropolitan Engineering Co., manufacturers of electric signs.)

COMMERCIAL manager, having had 8 years' successful experience in new business development and public relations, desires to change his location to Middle West or Northwest, as assistant to general manager or as commercial manager. Box 2257, Elec. World.

COMMERCIAL engineer, familiar with motor design, technical graduate, eight years' manufacturing experience, desires position with electrical manufacturer or concern handling electrical applications, moderate salary, good references. Box 2249, Elec. World, Real Estate Trust Bldg., Philadelphia, Pa.

ELECTRICAL ENGINEER
Technical Education

experienced in design of

Automobile Electrical Equipment

and capable of filling position calling for executive ability, will be open for engagement about July 10th. Correspondence solicited.

Box 2332, Electrical World
1570 Old Colony Building, Chicago, Ill.

POSITIONS WANTED

ELECTRICAL engineer, technical graduate, G. E. test, wiring, illumination, business experience, desires position with live contractor or willing to invest about $1,000. South preferred. Box 2339, Elec. World, 1570 Old Colony Bldg., Chicago, Ill.

ELECTRICAL engineer, age 29, technical graduate, 2½ years testing and engineering departments large manufacturer, one year public utility company, good mathematical ability, desires position along designing, testing or research lines. Box 2335, Elec. World, 1570 Old Colony Bldg., Chicago, Ill.

ELECTRICAL engineer, graduate, nine years' operating steam and water power. Experience in civil, electrical and mechanical engineering. Specialist on valuation, transmission and distribution systems, city and interurban railways. Box 2358, Elec. World, 1570 Old Colony Bldg., Chicago, Ill.

ELECTRICAL engineer or superintendent, technical education, fifteen years' experience in superintendence, construction and operation of central station properties. Age 37; married; strictly temperate. Services available on two weeks' notice. Best references. Box 2070, Elec. World.

ELECTRICAL engineer, 26, clean cut and ambitious, wishes position as assistant in power station. Five years' experience, principally station testing, station instruments and construction work. Can furnish best of recommendations as to character and ability. Box 2258, Elec. World.

ELECTRICAL mechanic, 18 years' practical experience in installation and repair, 10 years in executive positions, capable of taking entire charge of plant of any size. Married, age 40, sober and industrious. Good technical education, best of references. Box 2009, Elec. World, 1570 Old Colony Bldg., Chicago, Ill.

ELECTRICIAN with central station experience on remote control, oil switch, switchboard wiring, instruments, bus and conduit construction and miscellaneous electrical work, desires position. Box 2311, Elec. World, 1570 Old Colony Bldg., Chicago, Ill.

ESTIMATOR and superintendent of electrical construction work, 17 years' experience in all branches. Would like to connect with good concern. Box 2334, Elec. World.

EXECUTIVE position desired by a man of broad experience and technical knowledge. Accustomed to meet all sorts of men. Would be valuable to a corporation to relieve an overworked president or other executive, so that he could extend his usefulness. Now at work but desire larger opportunity. Record and reference at right time. Box 2290, Elec. World.

GRADUATE electrical engineer, 28, married, with experience in mill and building construction, electrical equipment, contraction and outside line work. Drafting experience on substation and power apparatus. Steady position desired. Box 2342, Elec. World, Real Estate Trust Bldg., Philadelphia, Pa.

MAN with 20 years' selling experience handling electrical goods in New York desires position with prospects of advancement. Has had executive training. Best of references. Box 2212, Elec. World.

MANAGER of combination electric and ice plant in the south desires similar position in Latin-American country. Experienced on inside wiring, overhead work, meters, obtaining of new business and now operating ice and light plant constructed under his supervision. Can prepare reports on plants in detail and is first class estimator. Box 2347, Elec. World, 1570 Old Colony Bldg., Chicago, Ill.

SEARCHLIGHT SECTION

POSITIONS WANTED

OFFICE man wants permanent position. Now responsibly employed assistant to sales engineer; three years' practical and four years' office experience. Speak Spanish. Age 28, good education and habits; $125 month. Box 2259, Elec. World, Real Estate Trust Bldg., Philadelphia, Pa.

POSITION as superintendent or manager of electric light and power plant or in large constructive work. American, married and sober. Have had 20 years' experience in all lines of electric work. Prefer a plant not on paying basis, but with prospects. Box 2333, Elec. World, 1570 Old Colony Bldg., Chicago, Ill.

PURCHASING agent, married, six years' experience in up-to-date purchasing and storeroom methods. Present engaged. Services available July 15th. Box 2343, Elec. World, Real Estate Trust Bldg., Philadelphia, Pa.

SALES engineer experienced in executive and sales work, desires position with central station or manufacturer of electrical equipment. Technical graduate, age 30. Box 2279, Elec. World, 1570 Old Colony Bldg., Chicago, Ill.

SUPERINTENDENT or general foreman of inside electrical construction, 18 years' extensive experience in all methods of installation, fireproof construction, power, lighting, etc. Experienced in estimating, superintending, laying out work and handling men to get results. Highest reference as to integrity and ability from past and present employers. Box 2337, Elec. World, Real Estate Trust Bldg., Philadelphia, Pa.

SUPERINTENDENT desires position with gas and electric central station. Nine years' experience, five years as general superintendent of company now employed by. Technical graduate. Good reference and a good record. Box 2356, Elec. World, 1570 Old Colony Bldg., Chicago, Ill.

SUPERINTENDENT of central station or of construction and distribution. Technical graduate, 12 years' experience. Can produce results and guarantee efficient and economical management. Box 2224, Elec. World, Real Estate Trust Bldg., Philadelphia, Pa.

TECHNICAL graduate, 30, desires position with power company, Middle West preferred. One year's experience in installation and construction and one in Westinghouse testing department. Box 2295, Elec. World, 1570 Old Colony Bldg., Chicago, Ill.

TECHNICAL graduate, age 32, have broad experience with hydro-electric power stations and in operating and purchasing departments of electric railways. Speaks, reads and writes Spanish, can furnish best recommendations, now employed but desires change for good reasons. Wants position as electrical engineer, purchasing agent or assistant to manager of electric railway or power property. Box 2359, Elec. World, 1570 Old Colony Bldg., Chicago, Ill.

POSITIONS VACANT

ARMATURE winder wanted; motor repair man with electrical repair shop experience. State age, length of time employed last place, salary. Send post card photo. Want man with ability and good character. E. C. Armstrong, 34 Macomb St., Detroit, Mich.

ASSISTANT general foreman wanted to fill position with a large electric light and power company of the Middle West. Must be a first class construction and maintenance man on both A.C. and D.C. In answering please state former employers, your age at the present time, and salary expected. Box 2264, Elec. World, 1570 Old Colony Bldg., Chicago, Ill.

POSITIONS VACANT

DESIGNING engineer wanted by a manufacturer of electrical specialties, particularly industrial and street lighting fixtures. Must have originality and inventive ability. Unusual prospects for the right man. In writing give full information as to education and experience. All applications treated confidentially. Address Box 2285, Elec. World, 1570 Old Colony Bldg., Chicago, Ill.

EXPERT meter and relay tester for maintenance and test work by a large hydroelectric company in the East. Only men with a good technical education and a thorough knowledge of Westinghouse and General Electric relays and wattmeters need apply. Good prospects for the right man. In applying state age, education, experience, salary expected, etc. Box 2280, Elec. World, Real Estate Trust Bldg., Philadelphia, Pa.

GOOD opportunity is afforded one having a thorough knowledge of the design and application of carbon-break circuit breakers. Only those having had actual experience will be considered. State briefly qualifications and references. Box 2269, Elec. World.

MANAGER, graduate electrical engineer with several years' practical experience in managing high grade employees and plant operations. Must possess tact and diplomacy; a good knowledge of photography helpful. State salary and experience in application. Box 2350, Elec. World.

MANUFACTURER of electric cooking and heating appliances wants a live salesman who has had experience in the sale of electric ranges and industrial heaters. Must have good references as to past success. Address, stating age, experience and salary expected, Box 2344, Elec. World.

OPPORTUNITY is afforded one having a thorough knowledge of the design and application of high and low tension oil switches. Only those having had actual experience will be considered. State briefly qualifications and references. Box 2268, Elec. World.

SALESMEN wanted—Young men experienced in the selling of electric service, for central stations; permanent positions with good pay and advancement to men showing ability. Address W. A. Dannenhauer, 603 Market St., Wilmington, Del.

SUPERINTENDENT wanted to take charge of electric plant. Must have experience in plant operation and in handling the public. Please state qualifications, experience, and salary expected. Box 2345, Elec. World.

TECHNICAL graduate wanted with practical experience, to teach electrical and laboratory subjects in short course technical school. Some teaching experience preferred. Well paid from start, good future. State experience in detail, present salary and work. Box 2341, Elec. World, 1570 Old Colony Bldg., Chicago, Ill.

TRAVELING salesman wanted to handle telephone apparatus, fire alarm and hospital signal systems, bells and annunciators. State experience and salary expected. Box 2338, Elec. World, 1570 Old Colony Bldg., Chicago, Ill.

WANTED—By the Atlantic Light & Power Company, Coeymans, N. Y., a strictly sober, efficient Diesel engineer—one fully capable of handling a board with A.C. current from four engines. Steady job to the right man.

WANTED—In operating position, technical graduate, sub-station construction, maintenance, also steam plants. Address Box 2320, Elec. World, 1570 Old Colony Bldg., Chicago.

AGENTS AND SALESMEN

Eastern Representative

Manufacturers of electrical equipment and supplies, wishing Eastern representation on salary or commission basis, can secure the services of a young electrical engineer with 12 years of technical and practical experience. For past four years have had charge of large steel industrial concern in Philadelphia. Desire change. References. Box 2247, Elec. World, Real Estate Trust Bldg., Philadelphia, Pa.

N. Y. Salesman Wanted

Electric Motor Manufacturer in East desires competent salesman for New York City territory. Man with technical education, experienced in the line and territory preferred. State age, training and previous experience. Excellent opportunity for real salesman. Box 2351, Elec. World.

Salesman Wanted

Salesman with technical education to sell high grade recorders and efficiency instruments. State age, education, experience, and salary desired to start. Box 2354, Elec. World, Real Estate Trust Bldg., Philadelphia, Pa.

EMPLOYMENT AGENCIES

AMERICAN SERVICE COMPANY, General Engineering Agency, Pittsburgh, Pa., require engineers with hydro-electric paper mill construction experience; electrical draftsmen for construction-installations; hydro-electric operators, $70-$100; mining electricians, $125-$175, for South America, West Coast, also for Middle Western States; stationary engineers, $75-$150, for mines, factories; instructors for Eastern-Western colleges; telephone engineers, factory foremen, steam-electric chief engineers for public buildings, Eastern; water works resident engineers, Western; gas power engineers, master mechanics, millwrights; hydro-mechanical designers.

EDUCATIONAL

BLISS ELECTRICAL SCHOOL, WASHINGTON, D. C.—Condensed Course in Electrical Engineering, complete in one year. Thorough—practical—scientific, theoretical and applied electricity, mathematics, mechanical drawing and necessary engineering training. No superficial or non-essential studies. Actual construction, installation and testing. For young men of energy and character. 24th year opens Sept. 27. Write for catalog. Address 129 Takoma Ave.

METERMEN WANTED to enroll for complete practical course in "Electrical Measuring Instruments and Meters." Endorsed by leading electrical men. Write for booklet, "Instruments and Meters," giving full information. Fort Wayne Correspondence School, 913 Shoaff Bldg., Fort Wayne, Ind.

RENSSELAER POLYTECHNIC INSTITUTE, TROY, N. Y.—Courses in Civil, Mechanical, Electrical and Chemical Engineering and General Science, leading to the degree of Civil Engineer (C.E.), Mechanical Engineer (M.E.), Electrical Engineer (E.E.), Chemical Engineer (Ch.E.) and Bachelor of Science (B.S.). Also special courses. Splendidly equipped new engineering laboratories. Send for catalog to the Registrar.

ROSE POLYTECHNIC INSTITUTE, TERRE HAUTE, IND.—A College of Engineering. Courses in Mechanical, Electrical, Civil, Chemical and Architectural Engineering. Extensive shops, well equipped laboratories in all departments; expenses low. Thirty-third year. For catalog containing full information and professional register of alumni address C. L. Mees, President.

"Beldenite"
TRADE MARK

N. E. C. S.

RUBBER COVERED WIRE

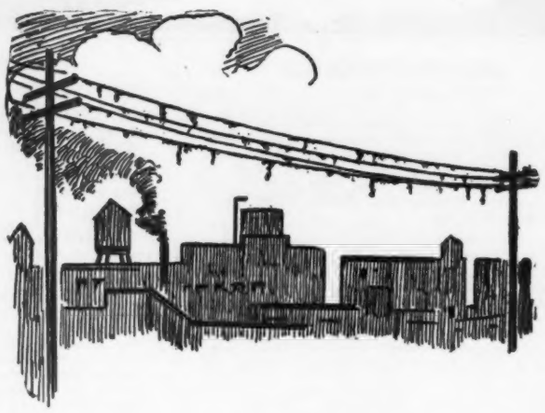
For Power, Lighting, Heating, Telephone and Ignition

Made with either solid or flexible conductor and dry, paraffined, weather proof or varnished braid.

We manufacture a complete line of Electrical Wires, Cords, Cordage and Cable.

BELDEN
MANUFACTURING COMPANY
2323 So. Western Avenue
CHICAGO

C-12



WEATHER-PROOF TRADE MARK "O.K." LINE AND HOUSE WIRES

This represents the class of insulation frequently seen on the lines.

Not the kind we manufacture.

Phillips Insulated Wire Co.
Pawtucket, R. I.

2541 1

D&W

Fuses
"Deltabeston" Wires, Oil Fuse Cutouts, Subway Cutouts
Bulletins on request.
D & W FUSE CO., PROVIDENCE, R. I. 1

Silk and Cotton Covered Lamp and Show Window Cord

WIRES And Cords

Cables for Automobile Lighting Systems

Lowell Insulated Wire Company
Lowell, Mass.

1

ALUMINUM

Electrical Conductors

Ingot Sheet Wire Rod Tubing

Aluminum Company of America
Pittsburgh, Pa.

Sales Offices
New York, Boston, Chicago, Cleveland, Detroit, Philadelphia, Rochester, N. Y., Kansas City, Washington 1

SEAMLESS RUBBER SAFETY INSULATIONS

SAFETY INSULATED WIRE & CABLE CO.
114 Liberty Street. NEW YORK
CHICAGO BOSTON
SAN FRANCISCO

WINDING MACHINERY
WIRE ENAMELING MACHINERY
RUBBER COVERED WIRE PANNING MACHINERY
American Insulating Machinery Co.
Fairhill and Huntingdon Streets PHILADELPHIA, PA.

"Withstanding Oxidation Made the 'Nichrome' Reputation"

Nichrome
is the standardized resistor
for quality heating devices.

DRIVER-HARRIS WIRE CO.
CHICAGO 28 So JEFFERSON ST. HARRISON, N. J. MANCHESTER ENGLAND
1

The American Brass Co.

BENEDICT & BURNHAM BRANCH
Successors to
THE HOLMES, BOOTH & HAYDENS CO.
WATERBURY, CONN.

SUPERIOR WEATHER PROOF "K.K." ELECTRIC WIRES
TRADE MARK

Manufacturers of
"K.K." Weatherproof Wire and Cable
Bare Copper Wire and Cable
Slow Burning Weatherproof Office Annunciator and Magnet Wire

NEW YORK OFFICE
195 Broadway

The Highest Attainment of Insulation Permanence

AWARDED PANAMA PACIFIC GRAND PRIZE

Made by
American Steel & Wire Company

Chicago New York Cleveland Pittsburgh Worcester Denver
Export Representative: U. S. Steel Products Co., New York
Pacific Coast Representative: U. S. Steel Products Co.
San Francisco Los Angeles Portland Seattle

TRADE MARK

Look for the Diamond M

Magnet Wire

We carry a complete stock of cotton, silk and enamel magnet wire in our various warehouses throughout the country.

ALFRED F. MOORE
200 N. Third St., Philadelphia
NEW YORK CLEVELAND CHICAGO BOSTON
CHATTANOOGA NEW ORLEANS

DOLPHIN
INSULATED WIRE

Notable for its uniformly high quality and dependability.

ATLANTIC INSULATED WIRE & CABLE COMPANY
Sales Office:
120 Liberty Street, New York
Factory: Stamford, Ct.

DOLPHIN ATLANTIC
Commercial Code

CONDENSITE
Molded Insulation

Condensite is not a mere compound or admixture of old substances, but a unique synthetic chemical product.

All the properties essential to good insulation are combined in higher degree in Condensite than in any other substance.

It contains no water either free or combined and will not absorb it. It is a splendid dielectric, showing a strength of 400 volts in a thickness of 150 mils and better. It is very hard and retains its finish. It is not affected by temperatures below the point of carbonization. It is high in mechanical strength, showing per square inch a tensile strength of 5,000 lbs. crushing of 25,600 lbs. cold, 11,070 at 218° F, transverse 3,070 lbs. for a 1½" section between 8" centers. It can be molded with all kinds of metal inserts.

We do not do any molding ourselves, but furnish Condensite in a condition ready to use to the molding trade whose names we will furnish on request.

Condensite technical cements and impregnating enamels are other preparations of this substance of particular interest to the electrical industry.

Descriptive pamphlets on request.

Condensite Company of America
Bloomfield, N. J.

FIELD
COILS
SOLENOIDS
ELECTRO
MAGNETS
MAGNET WIRE

THE ACME
WIRE COMPANY

NEW HAVEN
CONNECTICUT

H.N.FENNER, PRES. J.F.BLAUVELT, AGT. R.W.KNIGHT, TREAS.

NEW ENGLAND BUTT CO.

Manufacturers of
INSULATING MACHINERY
Braiding, Taping, Winding, Twining, Cabling, Stranding, Polishing and Measuring Machines, Cable Covering Braiders. (3)

FINE CASTINGS A SPECIALTY
304 PEARL ST.
PROVIDENCE, R. I.

INSULATED WIRES AND CABLES

Aerial Cables	Fire and Weatherproof Wire
Annunciator Wire	Field Coils
Automobile Horn Cord	Lamp Cord
Automobile Lighting Cables	Moving Picture Cord
Automobile Starter Cables	Mining Machine Cables
Automobile Charging Cables	Magnet Wire
Automobile Ignition Cables	Power Cable, Rubber Insulated
Armature Coils	Power Cable, Cambric Insulated
Bare Copper Wire	Power Cable, Paper Insulated
Bare Copper Strands	Slow Burning Wire
Copper Wire, Bare	Telephone Cable, Paper Insulation
Cambric Cables	Telephone Cable, Rubber Insulation
Fixture Wire	Weatherproof Wire

John A. Roebling's Sons Company
Trenton, N. J.

BRANCHES: New York Boston Chicago Philadelphia Pittsburgh Cleveland Atlanta San Francisco Los Angeles Seattle Portland, Ore.

Baker Standard Quality
Platinum
Wire, Sheet, Rivet and Contacts

We purchase and exchange
Platinum Scrap

BAKER & CO., Inc.
Murray & Austin Streets
Newark, N. J.
New York Office
30 Church St.

TOOLS

for all classes of electrical construction and repair work. Write for catalog.

Mathias Klein & Sons Canal Station 32 **Chicago**

CABLING MACHINERY

AND SPECIAL MACHINERY of any description

The Torrington Mfg. Co.
Torrington, Conn.
U. S. A.

POLES WESTERN CEDAR **PILING**

We brag about the SERVICE we give

B. J. CARNEY & CO.

E. B. BRANDE, Manager
819 Broad Street, Grinnell, Ia.

M. P. FLANNERY, Manager
542 Peyton Bldg., Spokane, Wash.

Commit us to memory.

One-O-Four

Our bulletin No. 104 covers miscellaneous

Malleable Iron Fittings

such as bus bar clamps, cable racks, floor air boxes, switchboard and pipe fittings, etc.

Write our nearest representative for your copy.

Akron, O., Flatiron Bldg., Verne W. Shear & Co.
Birmingham, Ala., Brown-Marx Bldg., Moore Engineering Co.
Boston, Mass., 84 State St., James C. Barr.
Cincinnati, Ohio, Traction Bldg., James A. Brett, Jr.
Denver, Colo., Gas & Electric Bldg., More Electric Co.
Detroit, Mich., 616 Ford Bldg., F. R. Jennings Co.
Duluth, Minn., Burgess Electric Co.
Indianapolis, Ind., 318 American Central Life Bldg., Indianapolis Engineering Co.
Kansas City, Mo., Traders' Bldg., O. & M. Supply Co.
Los Angeles, Cal., 626 San Fernando Bldg., R. B. Clapp.
New Orleans, La., Hennen Bldg., C. B. Tucker Co.
New York, N. Y., 114 Liberty St., Lewis & Roth Co.
Philadelphia, Pa., 311 Denckla Bldg., Lewis & Roth Co.
Richmond, Va., 301 American National Bank Bldg., The Hawkins-Hamilton Co., Inc.
St. Louis, Mo., La Salle Bldg., W. L. Rose Equipment Co.

Distributors—Northern Electric Co., Ltd., CANADA.

ELECTRICAL ENGINEERS EQUIPMENT CO.
711-715 Meridian St., Chicago
Specialists in the Manufacturing of High Tension Transmission and Station Electrical Equipment
Designers and Builders of POWER PLANT APPLIANCES

PERFECT MICANITE INSULATION REGISTERED

And Other Dependable Insulations

Bulletins for the asking

Mica Insulator Company

Manufacturers

68 Church Street, New York — **542 So. Dearborn Street, Chicago**

Schenectady, N. Y.

M-R INSULATION MFG CO

Mitchell-Rand Mfg. Co.

Electrical Insulating Materials
of every description

Office: 99 John St., New York City

RESISTANCE WIRES AND RIBBONS

CALIDO

Highest Quality Resistor for Electrically-Heated Appliances

Ideal — "Spark Point Nickel" — Pure Nickel
Phenix — Alloy 67 — German Silver

ELECTRICAL ALLOY CO., Morristown, N. J.
NEW YORK, 41 Union Square

National Fibre & Insulation Company

Yorklyn, Delaware

Vulcanized Fibre Specialties

Send us your specifications of insulating pieces, and let us make samples for trial

Attractive Prices

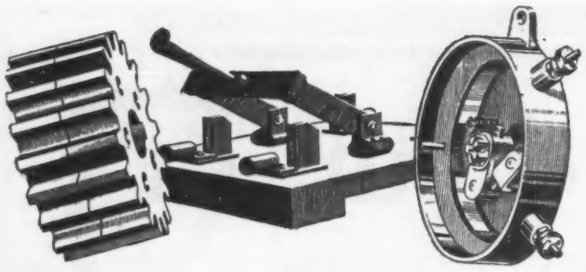
Large Stock of

Sheets, Rods and Tubes

Prompt Shipment

SPECIFY "OLD HICKORY"

Branches in All Principal Cities



—for gears
—for insulation

VUL-COT Fibre is an infallible insulator.

It also makes noiseless and practically wearless gears.

It can be machined easily and accurately. You can drill, tap, bore, turn, bend, saw, stamp and emboss it—but you can't mould it.

The double-throw switch and the gasoline engine timer are VUL-COT Fibre insulated.

The gear shows how VUL-COT Fibre can be machined.

VUL-COT Fibre can't fracture when it isn't excessively overloaded; it won't split; no ordinary force can crush it; in this finished form it won't shrink, warp, twist or expand beyond the slight natural expansion and contraction due to temperature changes.

May we send you prices and delivery dates on VUL-COT Fibre, either ready-machined or in sheets, rods, tubes or bars? A free blue print—39″ x 42″—showing a collection of *standardized* fibre designs, will also be sent on request.

American Vulcanized Fibre Co.

Largest Manufacturers of Vulcanized Fibre in the World

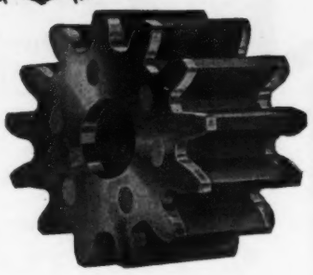
535-555 Equitable Building
Wilmington, Delaware

Vul-Cot Fibre

DISFICO
TRADE MARK REGISTERED

Smooth and Noiseless

You will eliminate the shocks and vibrations on machines and bearings when motors, generators and other high speed drives are equipped with



Diamond Fibre Gears

There are many other economies they effect which are worthy of your investigation. Give them a trial in your plant. The cost is trifling compared to the result sure to follow.

Write now to our Gear Dept. for Special Bulletin No. 13.

For toughness—for insulating qualities—for ease of working—for imperviousness to oils and chemicals—the ideal insulating material is Diamond Vulcanized Fibre. Write for particulars.

Diamond State Fibre Co.
Elsmere, Del., Chicago, Ill., Bridgeport, Pa.

Blake Insulated Staples

Unequalled for telephone and bell wiring. The fibre insulation prevents troublesome short circuits and grounds. 5 Sizes. Pat. Nov., 1900. Write for Samples.

Blake Signal & Mfg. Co.
Boston, Mass.

HARD PORCELAIN

For Electrical Specialties

IMPERIAL PORCELAIN WORKS

TRENTON, N. J.

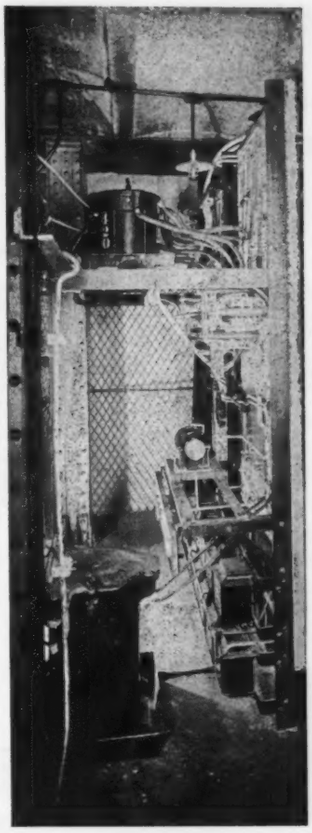
Free Samples of

LAVITE INSULATION

sent on request. Wonderful Heat resisting qualities.

Machined to most any shape.

D. M. Steward Mfg. Co., Chattanooga, Tenn., U. S. A.



Protection Where High Voltage Wires Interlace

requires extra defensive measures at connections or splicing.

Ideal and Utility Friction Tapes

provide permanent, high dielectric protection for circuits at danger points—insulation which does not weaken with age, does not dry out, is moisture-proof and resists high temperatures.

The Mechanical Rubber Company
Cleveland

Mica Mica Mica Mica Mica Mica Mica
Mica Mica Mica Mica Mica Mica Mica
Mica Mica Mica Mica Mica Mica Mica
Mica Mica Mica Mica Mica Mica Mica
Mica Mica
Mica **THE TAR HEEL MICA CO.** Mica
Mica **Plumtree, N. C., U. S. A.** Mica
Mica Mica
Mica Mica Mica Mica Mica Mica Mica
Mica Mica Mica Mica Mica Mica Mica
Mica Mica Mica Mica Mica Mica Mica
Mica Mica Mica Mica Mica Mica Mica

UNCUT MICA

All sizes—clear or stained or spotted. We absolutely will not quote for cut or stamped material. Send samples of what you require, mentioning quantities. We will quote you by return mail.

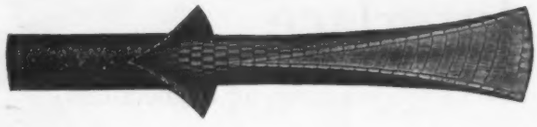
American Mineral Grinding Co
Dept. E. W. Box 1204
Atlanta, Ga.
Branch Office: 933 Marquette Bldg., Chicago, Ill.

BAKELITE-DILECTO
WATERPROOF PERMANENT STRONG
A laminated *Insulating* material of highest efficiency. Also
VULCANIZED FIBRE
In Sheets—Rods—Tubes—Special Shapes.
THE CONTINENTAL FIBRE CO. Newark, Delaware
CHICAGO, McCormick Bldg. **NEW YORK,** Woolworth Bldg.

Oiled Paper Varnished Cambric Oiled Silk

IRVINGTON VARNISH & INSULATOR CO.
Irvington, New Jersey.

"LOOMFLEX"
Flexible Conduit



Why consider the destructible when you can have the indestructible?

No matter how badly crushed, twisted or kinked, "Loomflex" can always be pinched back into shape and used. Easy to fish—all sizes are slightly oversized and there are no seams to break loose. The roller-bearing construction of the interior allows the wire to slide through with a minimum of friction.

Write for samples.

AMERICAN CIRCULAR LOOM CO. TRADE MARK

American Circular Loom Co.
90 West St., New York

Boston Los Angeles Seattle
Chicago San Francisco Toronto

1

Locating trouble in cable terminal house with a
Lundin Fault Locater

Exploring Coils pick up the signal sent out by the Interrupter. The fault is located by the difference in sound on either side of the trouble.

Any ordinary troubleman without technical training can quickly and accurately find the location of the trouble, on underground or overhead cables or wires of any Central Station system.

He can tell before going out on the circuit whether a gang will be needed to draw in a section of cable, whether a manhole will have to be pumped out, or Transformer replaced, etc.

In use by the Boston Edison Company and many other companies.

THE LUNDIN ELECTRIC & MACHINE CO.
8 Thacher St., Boston, Mass.

"Beats any Baking Varnish I ever saw"—That is what we frequently hear from Master Mechanics and Shop Foremen, after they have tested out our Baking Varnish. Costs no more than other Varnishes. Let us submit sample.

P & B
Baking Varnish—Clear or Black.
Black Finishing Varnish—Oilproof.
Black Air Drying Varnish.
Core Plate Varnishes.

Also
The old P & B Compound and
P & B Tape
that you have always used.

Send for Booklet No. 55

The Standard Paint Company
Woolworth Building, New York
Chicago Denver Boston

8

STERLING
Insulating Varnishes and Compounds

HIGHEST GRADE STANDARD OF QUALITY

Clear and Black Air Drying Insulating Varnishes
Clear and Black Baking Insulating Varnishes
Oil Proof Finishing Varnishes
Impregnating Compounds
Wire Enamels

FOR THE MANUFACTURER—OPERATOR—REPAIRER

Inquiries invited. Catalogue on request.
We gladly assist in selection.

THE STERLING VARNISH COMPANY
PITTSBURGH, PENNA.
Manchester, England

When You Need
Moulded Electrical Insulation

Send Blue Prints or Models and ask *us* to quote on *your* requirements.

DICKINSON MFG. CO.
Established 1875 as Dickinson Hard Rubber Co.
SPRINGFIELD, MASS.
KURT R. STERNBERG. Treasurer and General Manager

MONSON SLATE
for all ELECTRICAL PURPOSES
Strength, High Quality

PROMPT SHIPMENTS, ALL SIZES

PORTLAND-MONSON SLATE CO., Portland, Me.

APOLLO
Special ELECTRICAL SHEETS

Of Silicon Alloy Steel, Patented. Highest grade Electrical Sheets manufactured for transformers, dynamos and motors; insuring minimum heating, maximum capacity, non-aging. Other standard sheets are American Armature, U. S. Electrical, and Pole Face. Write for full information.

AMERICAN SHEET AND TIN PLATE COMPANY, Pittsburgh

AMERICAN SHEET & TIN PLATE CO. APOLLO SPECIAL ELECTRICAL TRADE MARK REGISTERED PITTSBURGH

"FRANKLIN"

High-Tension Insulating Posts

Strong and effective supports for bus-bars and cable work

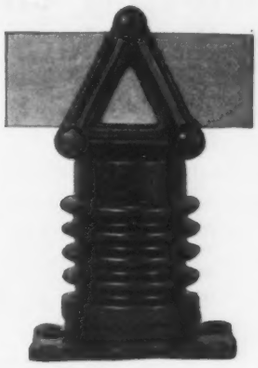
What they offer

Improved method of fastening both top and bottom elements.

Metal parts are prevented from unscrewing from vibration.

Lasting and efficient service as a result of wide engineering experience applied to their design.

Finished in white or brown glaze.



What they overcome

The necessity of clamping bolts, spring washers, cotter pins and ornamental brackets.

Danger of Static breakdown.

Clamping on the porcelain or weak cementing of brackets into end recesses.

Dirt pockets and fussy details.

Trouble from the hardest usage.

Various types with suitable fittings, supplied for all voltages and station conditions. Further details upon application.

Philadelphia Electric Company Supply Dept.

132 South Eleventh Street, Philadelphia

Perfect Mechanical Protection

is afforded by the Galvanized Steel Armor. Particularly desirable for use under conditions requiring extraordinary service.
Used in Theatres, Mills, Machine Shops, Boiler Rooms, Show Windows, etc., where

QUALITY FIRST

is demanded.

Write for Pamphlet No. 4403

SPRAGUE ELECTRIC WORKS

of GENERAL ELECTRIC COMPANY

Main Offices: 527-531 West 34th St., New York, N. Y.
Branch offices in Principal Cities.

Springs for Exacting Requirements

They are rigorously tested before they reach you. In all sizes and makes.
Steel Fishing Snake for Electrical Conduit Work. Send for our Booklet.

CARY SPRING WORKS
240-242 West 29th Street
New York

2

ANY SIZE OR MATERIAL

COOK SPRING CO.

106th STREET and EAST RIVER, NEW YORK

As sound as the cable itself

—mechanically and electrically trouble-proof—that's

Frankel Solderless Connectors

MAKERS OF THE BEST ONLY
FRANKEL
CONNECTOR CO. INC. N.Y.

the modern splicing time and money savers. ***Get our booklet.***

Factory: 177-179 Hudson St., N. Y.
Sales Rooms: 733-735 Broadway

Do You Want Both Quality and Service?

THEN ORDER NOW

40 Kva. 2200 Volt, 60 cycle, Single Phase A-B Transformer

Adams-Bagnall

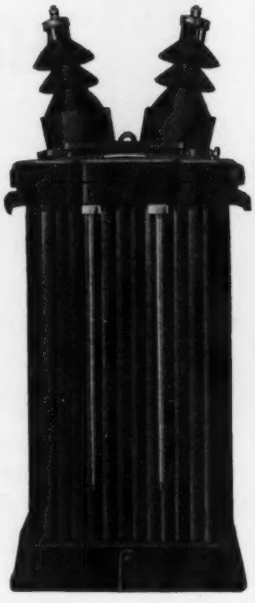
Distributing and Power Transformers

A-B transformers are always:

Safe in insulation;
Economical to operate;
Rugged and liberally designed;
Carefully manufactured;
Uniformly successful in operation.

Consistently a quality product backed by service.

If you are not getting A-B transformers just now, be sure to buy some; it pays! Try our shipment promises on your requirements.



22000 Volt, Outdoor Type, Single Phase. A-B Transformer

The Adams-Bagnall Electric Co., Cleveland, Ohio

Manufacturers of Electrical Apparatus of Merit: { Lighting; Industrial, Commercial and Street; Abolites. Transformers; Lighting, Power and Constant Current. Gyrofans; Oscillating Fans; Auto Electrical Accessories.

TRANSFORMERS

Manufactured for all electrical purposes in any size, frequency, or voltage.

Lighting and Power Transformers
High Transmission Transformers
Single and 3-Phase Transformers

To secure prices give us K. W. capacity voltage, cycles, transformers required.

MOLONEY ELECTRIC CO.
St. Louis, Mo. Windsor, Canada

District Offices:
New York Chicago San Francisco

Your Special transformer needs are our special interest

Besides our regular line of single phase and polyphase light and power transformers, covering every need of commercial service, we are also specially equipped to build transformers of special types. Our engineers have had wide experience in solving out-of-the-ordinary transformer problems. Let us help out with *yours*.

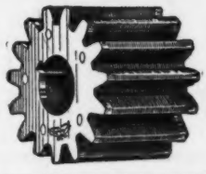
Kuhlman Electric Company
Bay City, Mich.

AMERICAN TRANSFORMERS
CUSTOM MADE
SUPERIOR DESIGN AND QUALITY, FOR EVERY USE
AMERICAN TRANSFORMER COMPANY
NEWARK, N. J.

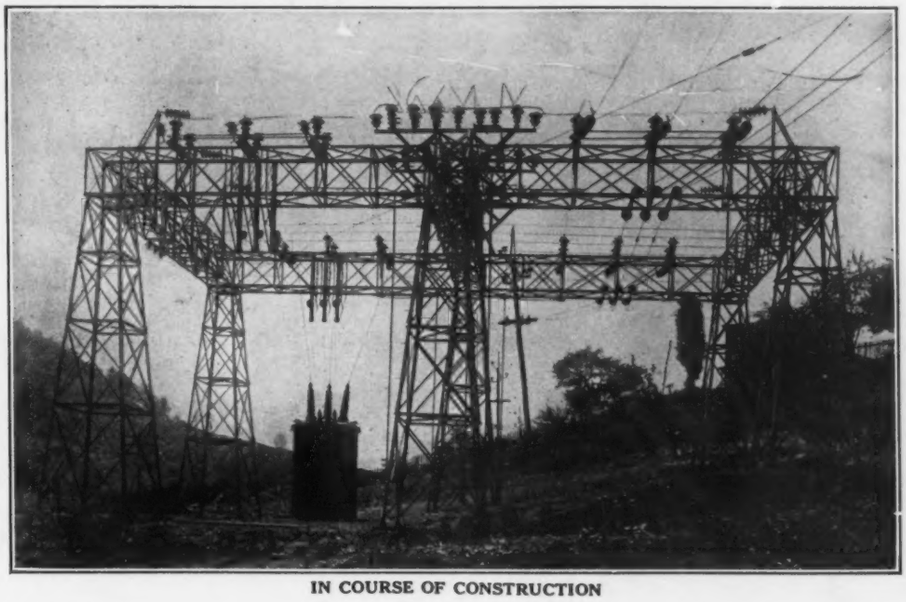
Noiseless Pinions

for motor and other high speed drives, see our large advertisement in first issue of the month.

New Process Gear Corporation
500 Plum St. Syracuse, N. Y.



66000 V-Out Door Transformer and Sectionalizing Station



IN COURSE OF CONSTRUCTION

This cut shows one of a large number of Out-Door Stations that we are prepared to ship on very short notice.

Provision is made at this station for additional transformer capacity.

Where none of our standard designs meet the requirements, we will send sketches showing a station we would recommend.

Experienced Engineers Head our Design-Manufacture-Sales

At the Center of a Coal Mine Load on the Lines of The Wheeling Elec. Co

Out Door Stations and Burke Equipment for every need

RAILWAY & INDUSTRIAL ENGINEERING COMPANY

PITTSBURGH, PA.

NEW YORK REPRESENTATIVE: No. 2 RECTOR ST.

Used Overhead Too

While the great bulk of

ORANGEBURG FIBRE CONDUIT

is used underground, there are many places where its resistivity to moisture, acids, alkalies and other corroding agents renders it invaluable for overhead work as well. Book E.

THE FIBRE CONDUIT COMPANY
ORANGEBURG, N. Y.
NEW YORK BOSTON CHICAGO SAN FRANCISCO

G. M. Gest

Contracting Conduit Engineer

Executive Offices
Woolworth Building
Cincinnati *NEW YORK* *San Francisco*

G. M. Gest, Limited

Montreal *Winnipeg* *Vancouver*

Acme Die Castings

Made by a highly-improved process

Incomparable in finish, accuracy and strength. Prompt service at reasonable cost; uniform work; best alloys.

Acme Die-Casting Corp., Bush Terminal No. 5, 35th St. and 3d Ave., Brooklyn, N. Y.

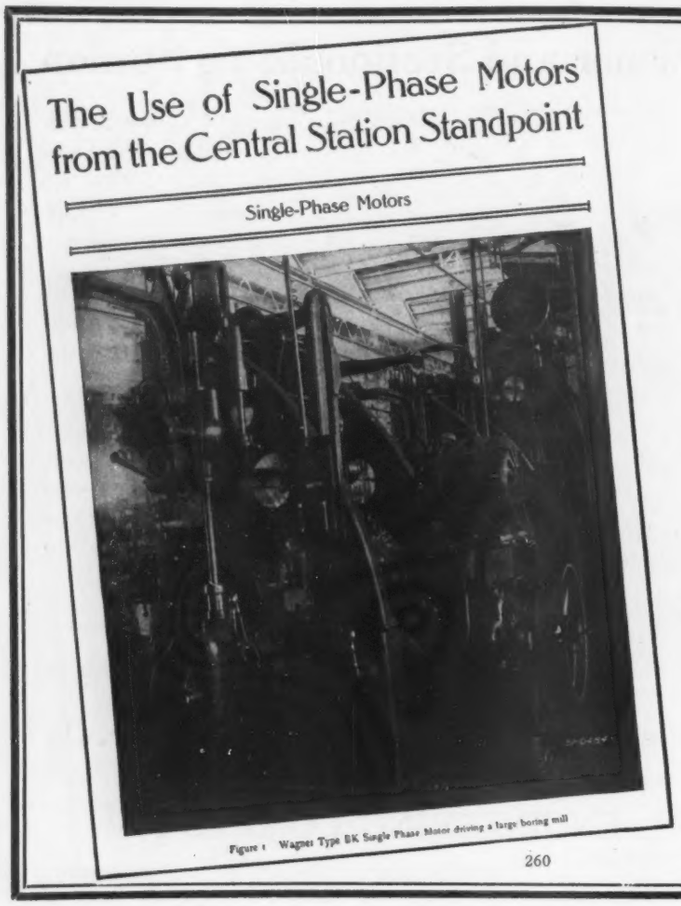
THE OHIO BRASS CO.
MANSFIELD, OHIO

O-B High Tension Insulators for any Voltage or Class of Service.

"Cope"

Underground Equipment and Tools

T. J. Cope
3244 No. 15th St., Philadelphia, Pa.


The Use of Single-Phase Motors from the Central Station Standpoint
Single-Phase Motors
Figure 1 Wagner Type BK Single Phase Motor driving a large boring mill
260

Every Central Station man should have a copy of this bulletin.

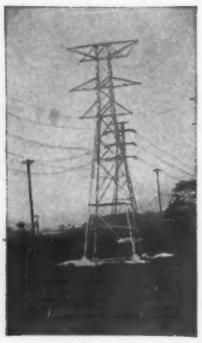
The single phase motor is primarily a Central Station motor, designed and built for the benefit of the Central Station. If you, Mr. Central Station Man, do not realize its importance to you, and the saving you may effect by advocating its use, you are neglecting your opportunities. Send for this Bulletin 1064 to-day. Also for booklet "Why?"

Wagner Electric
Manufacturing Company, St. Louis, Mo.

Blaw

FOR

TRANSMISSION TOWERS
STEEL POLES
A-FRAMES
STEEL BRIDGES
STEEL STRUCTURES
OF ALL KINDS



Blaw Steel Construction Co.
General Offices
Pittsburgh, Pa.
New York Chicago

2

When a Hubbell Machine Screw "Goes Home" It Stays Home

Doesn't drop in casual-like, rattle around a bit and then drop out again when you aren't looking. It settles right down on its job and takes permanent possession—a regular tenant on a long-term lease.

Good making is what makes Hubbell Screws good.

You'll save time in assembling and avoid consumers' kicks if you put your metal goods together with Hubbell Machine Screws.

HARVEY HUBBELL, Inc., Bridgeport, Conn.

1

Anderson Time Switches
combine all good features of switch manufacture
Albert & J. M. Anderson Mfg. Co.
289-293 A Street, Boston, Mass.

2

Collets on Dies Are Unnecessary

for true clean thread cutting when

TRADE MARK C Registered

CARPENTER'S Adjustable Dies

are used in **Carpenter's Adjustable Stock.** Standard for over 45 years.

Ask for complete catalog.

The J. M. Carpenter Tap and Die Co., Pawtucket, R. I.

FOREIGN REPRESENTATIVES:
Alfred Herbert, Ltd. (Coventry, England), Great Britain.
Schuchardt & Schutte—Berlin, Shanghai, Vienna, Stockholm, Tokio, Budapest, Copenhagen, St. Petersburg.
Alfred H. Schutte—Cologne, Brussels, Liege, Paris, Milan, Bilbao, Barcelona

1

FOR AUTOMATIC MOTOR STARTERS, LIFTING MAGNETS, CONTROLLERS, ETC.
CONSULT
THE ELECTRIC CONTROLLER & MFG. CO.
CLEVELAND, O.

A Great Current Saver!!

And an efficient, highly-improved time switch that proves itself absolutely dependable. Clock and motor operate independently. Practically nothing to get out of order in the accurate—

PARAGON TIME SWITCH

Write today for interesting free booklet and learn all about the Paragon Time Switch. Comes complete. No extras to pay for. Small, compact, all machinery easily accessible. Will last a life-time. And saves much current. Get free booklet today.

Paragon Electric Company
3 S. Clinton St., Chicago
305 Maritime Bldg., Seattle, Wash. 247 Minna St., San Francisco, Calif.

In An Emergency

G & W Detachable Potheads

Enable one man to accomplish more in less time than can be done by a fully equipped trouble gang where lines have to be cut and spliced.

TRUE ECONOMY PROVEN IN SERVICE

G & W Electric Specialty Co.
7440-52 So. Chicago Ave.
CHICAGO, U. S. A.

James M. Cory, New York, N. Y.
W. R. Hendrey & Co., Seattle, Wash.
Electric Material Co., San Francisco, Cal.
A. H. Winter Joyner, Ltd., Toronto, Ont.
General Supplies, Ltd., Calgary and Edmonton.
Chas. Farnham, Los Angeles, Cal.

G&W ELECTRIC SPECIALTIES

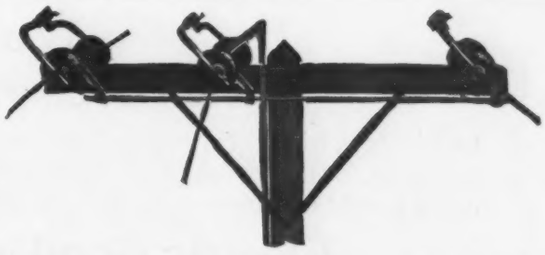
The Perfect Lighting Control

—a time-switch that can be relied on absolutely—that never needs attention beyond a weekly winding—that is as durable as it is dependable. Such a time-switch is the

CAMPBELL
EIGHT DAY TIME-SWITCH

Made in five types covering all light and power control requirements of Central Stations, Jobbers, Dealers and Contractors. A money maker for the dealer who sells it and a money saver for the user. Get acquainted; write for particulars and confidential prices.

Campbell Electric Co.
Main Offices and Factory: Lynn, Mass.



Make Any Pole a Self-Contained Unit

by sectionalizing your high-tension line with the

K-P-F Pole-Top Switch

This is a practical, strong, efficient disconnecting switch for sectionalizing high voltage transmission lines.

It is of the utmost simplicity in principle and construction.

The same insulators which dead-end your wires hold the switch contacts.

Installation reduces labor and material cost to a minimum.

The switch may be locked in either open or closed position.

Shipped ready for bolting to cross arm.

Bulletin 102 describes the K-P-F Switch in detail. Write for it.

K-P-F Electric Co.
37 Stevenson Street, San Francisco, Cal.

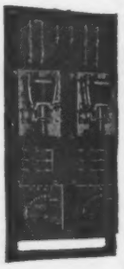
8345 2

Solenoid Operated Valve

Operates on pressures up to 100 lbs. air, steam, water.

Special Controlling Panels

Made in a large variety of types for all forms or service.



SUNDH

Electrical Control

A.C. D.C.

We annihilate distance. No matter where the machine or instrument may be located, we can tell you a way to control it from the most accessible spot you can select.

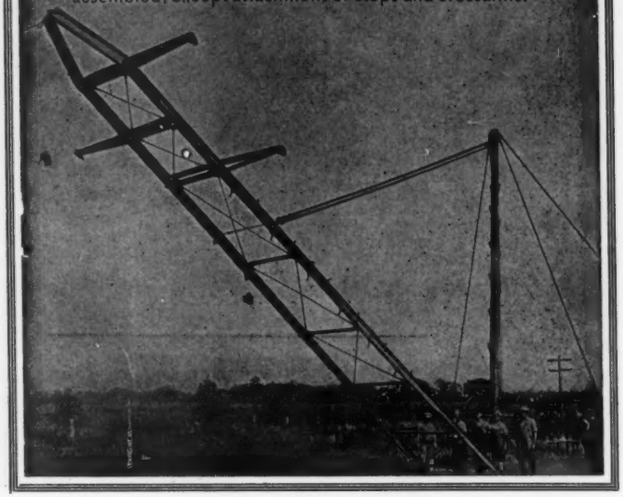
Sundh Electric Co.
555 W. 23rd St., New York 1

Steel Transmission Structures

Flexible Transmission Towers
Catenary Bridges

Archbold-Brady Co.
Syracuse, N. Y.

Installing A-frame structures with gin pole. On a 60,000 volt single circuit line similar to this 37 of these structures were erected in one 9-hour working day by 9 men, 1 foreman and 2 teams. Bases were already in place, and structures were shipped assembled, except attachment of steps and crossarms.



We Finance
Extensions and Improvements

to Electric Light, Power and Street Railway properties which have established earnings. If prevented from improving or extending your plant because no more bonds can be issued or sold, or for any other reason, correspond with us.

Electric Bond and Share Company
Paid-up Capital and Surplus, $16,000,000
71 Broadway, New York

Dealers in Proven Electric Light, Power and Street Railway Bonds and Stocks.

HIGH TENSION
STEEL TOWER OUTDOOR SUB-STATIONS
DELTA STAR ELECTRIC CO. CHICAGO
ICE PROOF POLE TOP P.M. SWITCHES
ASK FOR TECHNICAL BULLETINS

S C

PROTECTIVE DEVICES
FUSES
ARRESTERS
PRIMARY CUT-OUTS
SCHWEITZER & CONRAD, INC.
Berteau & Ravenswood Ave., Chicago

One of many.

FAHNESTOCK
Spring Binding Post

Simply press down on the spring; put in the wire and let go. Efficient, convenient and reliable. We make a number of different sizes and shapes. Send for catalog.

FAHNESTOCK ELECTRIC CO.,
Meadow St., Long Island City, N. Y.

ROYAL ELECTRIC MFG. CO.
616 E. Fortieth Street
CHICAGO

Designers and Manufacturers of High Tension Apparatus and Electrical Specialties

3-60 A Form 3 250-600 V

Save Time and Money

in your plant by protecting your circuits with

TRADE DAUM MARK

Renewable Fuses

They may be refilled over and over again. All they require is a new fuse element which can be quickly broken off from a *Daum Fuse Strip* and inserted in the fuse.

Write today for Bulletin J.

A. F. Daum Co., Pittsburgh, Pa.
Sole Manufacturers

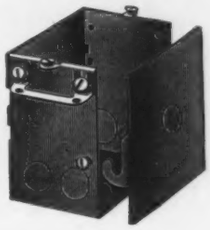
Representatives:
Willis C. Squire & Co., Western Union Building Chicago, Ill.
Geo. H. Trask, 76 Sacramento St., San Francisco, Cal.

1

"UNION" SWITCH AND OUTLET BOXES

The Sectional Switch Box has come to stay, for the contractor knows that its flexibility of construction more than offsets its slightly increased cost.

It is the work of only a few minutes to build a Gang Box from sections, while it may take hours or days to get a solid gang box from the jobber or factory. The sectional box also reduces the jobber's stock and avoids the accumulation of slow moving material.



The contractor can find a box for every requirement among the "Union" sectional Switch Boxes—depths from 2" to 3½"—square or beveled corners—with K. O. for "Loom," Flexible or Rigid conduit.

Fully listed and described in new No. 28 catalog. Write for a copy.

CHICAGO FUSE MFG. CO.
CHICAGO NEW YORK

Instantload Refill Fuse

Safe and reliable. Simplest reloadable fuse on the market.

N. E. C. S. Fuse

Highest possible standard. Efficient under every test.

Write for Catalog No. 1

ELECTRIC FUSEGUARD CO. NEWARK, N. J.
Agents for Railways—Bryant Zinc Co., Chicago, New York

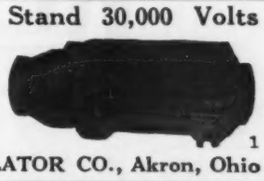
NEW
THOMAS
INSULATORS
have been designed to take care of new conditions

WRITE FOR FULL INFORMATION

R. Thomas & Sons Co.
Main Office: EAST LIVERPOOL, O.
Sales Offices:
61 Broadway, New York City
1290 Old Colony Bldg., Chicago, Ill.

This Pothead Will Stand 30,000 Volts

It's designed especially for arc work and will safely handle 100 on a circuit. Small and compact, but a giant in capacity. Ask for details.



1

COLONIAL SIGN & INSULATOR CO., Akron, Ohio

Accurate, Compact, Inexpensive

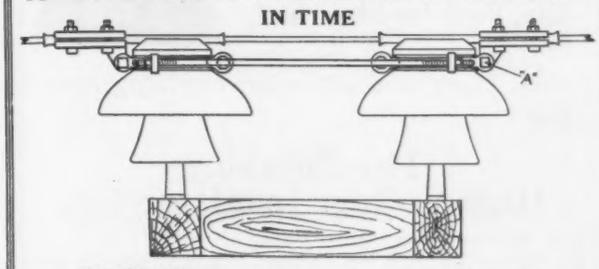
VOLTMETERS, AMMETERS and VOLT-AMMETERS

Send for complete catalog

LOUIS M. PIGNOLET
78 Cortlandt Street New York

A "PROTECTIVE CROSSING CLAMP"

IN TIME

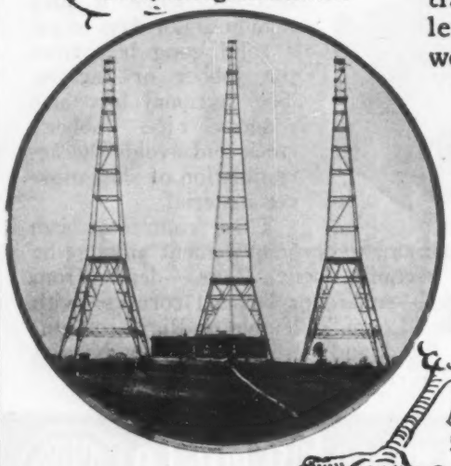


SAVES NINE accidents, maybe more and assures safety at the Overhead Line Crossing.

"HATCH SPECIALTIES" **844 Equitable Bldg. New York**

Government Work Calls For Insulator Quality

Victor Insulators At The U. S. Arlington Station



On government-controlled transmission lines and wireless stations high tension work has been entrusted to

"VICTOR" INSULATORS

as a safeguard against breakdown in service.

Why? Get "The Insulator Book" for the answer.

Locke Insulator Mfg. Co.

Victor, N. Y.

50 Church Street, New York

Victor Insulators At Panama

"Pittsburg"

Porcelain Insulators

The most successful high voltage insulators ever placed in operation. Install "Pittsburg" porcelain on that new line and make shutdowns a rare occurrence. We make an insulator for every kind of service, wall and roof outlets, floor bushing, line and suspension insulators. Get in touch with our Engineering Dept.

The Pittsburg High Voltage Insulator Co.

Main Office and Factory, Derry, Penna.
Westinghouse Electric & Mfg. Company, East Pittsburgh, sole agents for United States.
Canadian General Electric Company, Toronto, Canada, sole agents for Dominion of Canada.
Harmon S. Salt, 114 Liberty Street, New York, Export Agent.

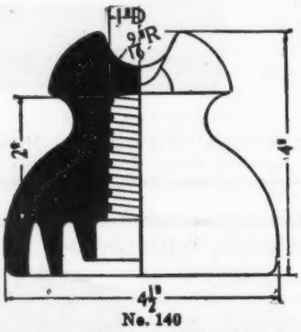
3

BROOKFIELD

REG U S PAT OFF

Insulators, Pins, Brackets

"Standard for Half a Century"



Write for Brookfield Bulletin

BROOKFIELD

REG. U. S. PAT. OFF.

GLASS COMPANY

2 Rector Street New York

Northern Electric Company
LIMITED

Distributors for the Dominion of Canada, Montreal, Halifax, Toronto, Winnipeg, Regina, Calgary, Edmonton, Vancouver, Victoria

This Galvanometer

is useful for a variety of purposes. It is sufficiently sensitive for most commercial Wheatstone Bridge Work. It is rugged enough to be used as a detector galvanometer.

Sensitivity—1 megohm.
Period—2½ seconds.
Resistance—200 ohms.

Production in quantity has made it possible for us to sell it at a low price.

Ask for Bulletin No. 232 and for quotation

The Leeds & Northrup Co.
Electrical Measuring Instruments
4903 Stenton Avenue, Philadelphia

Test the speed of Generators, Motors, Turbines, etc., with a

JAGABI HAND TACHOSCOPE

It is more accurate than a tachometer—and can be used for any values up to 20,000 r.p.m.

Write for Descriptive Bulletin 850

James G. Biddle
1211-13 Arch St., Philadelphia

Shelton Vibrators

Write for Catalog of Shelton Specialties

Shelton Electric Co.
New York Chicago
Boston San Francisco

Carbo Steel Poles

Perfect lightning protection.
No concrete settings required.
Sections nest together for shipment.
Send for full information.

The Carbo Corporation
Rand McNally Bldg., Chicago, Ill.

Are Your Watt-Hour Meters Accurate At Power Factors Less Than Unity?

Insure Reliability with our

Potential Phase Shifters

They will give you any power factor desired without an inductive load.

Circular No. 20 will be of value to you.

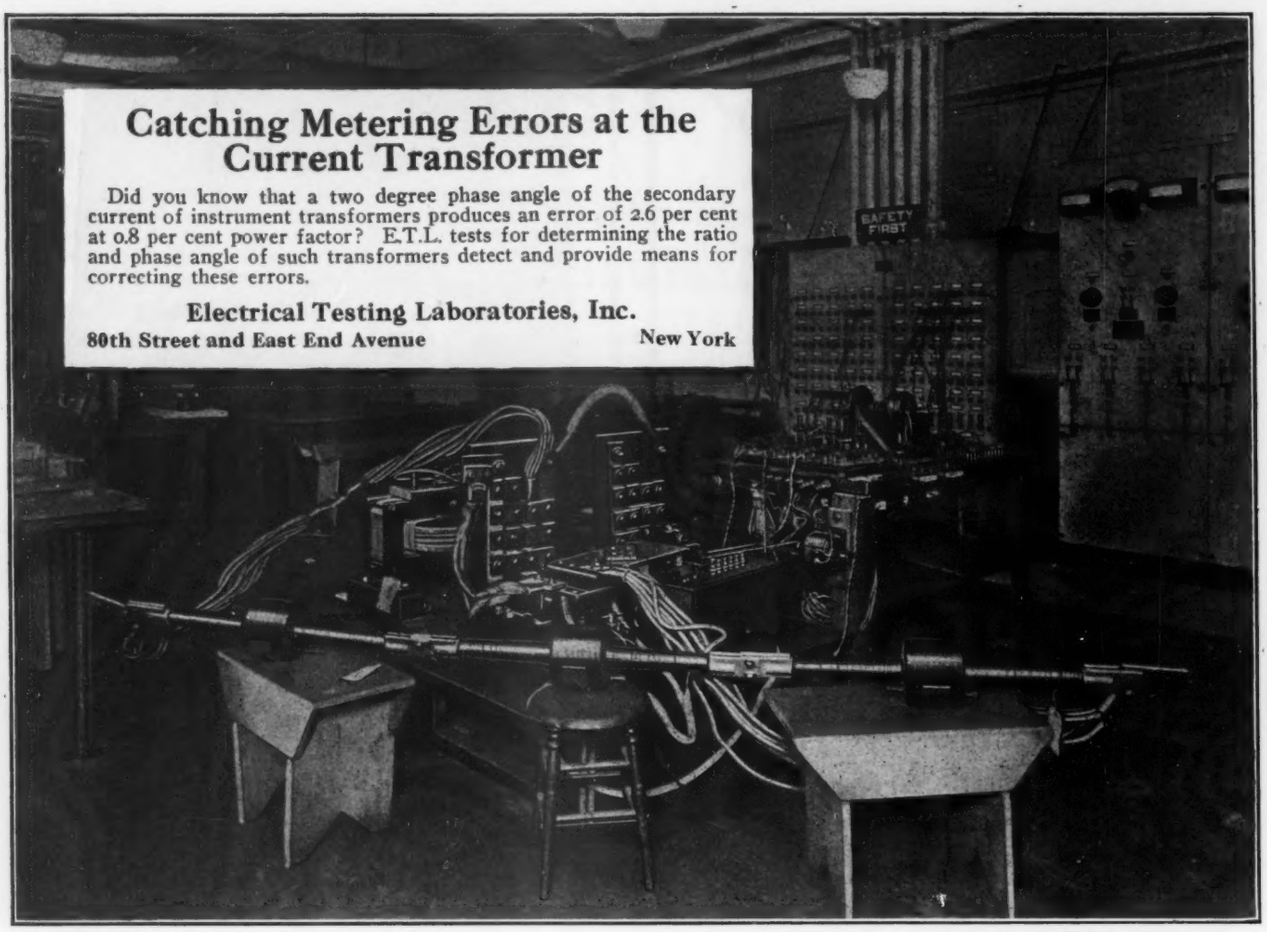
***The* States Company**
19 New Park Ave., Hartford, Conn.

Knopp A. C. Line Current Testing Set

The only A. C. line current testing set reading as low as 5 amperes

Every testing engineer can at once appreciate the vast convenience of an A. C. Line Testing Set with which readings as low as 5 amperes can be taken as easily as 250 amperes. Such an instrument is the Knopp A. C. Line Current Testing Set—the only set that combines in one instrument three working ranges—viz.: 0-30, 0-125, and 0-250. It's a time and money saver. Write for data.

Western Electro-Mechanical Co.
Oakland, California



Catching Metering Errors at the Current Transformer

Did you know that a two degree phase angle of the secondary current of instrument transformers produces an error of 2.6 per cent at 0.8 per cent power factor? E.T.L. tests for determining the ratio and phase angle of such transformers detect and provide means for correcting these errors.

Electrical Testing Laboratories, Inc.
80th Street and East End Avenue **New York**

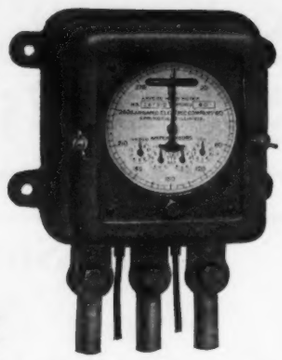
Voltmeters and Ammeters

Keystone
instruments are moderate priced but their quality is of the highest grade.
Catalogue No. 16 describes these well known instruments.

Keystone Electrical Instrument Co.
Philadelphia, Pa.
New York Pittsburgh Chicago 4

BUILT LIKE A WATCH

METERS for every Electrical need. Ask for Bulletins



Sangamo Electric Company SPRINGFIELD ILLINOIS
NEW YORK MINNEAPOLIS ROCHESTER LOS ANGELES 3

OSTRANDER

SAFETY FEATURES

—which are distinctive to this socket—are appreciated by the public.

Write for Bulletin 26 T.

W. R. OSTRANDER & CO.
371 Broadway, New York

BENJAMIN 92

The Double Duty Electric Plug

BENJAMIN ELECTRIC MFG. CO.
Chicago New York San Francisco Toronto London

SAMSON SPOT CORD

FOR HANGING ARC LAMPS
SOLID BRAIDED COTTON—WATER PROOFED
Send for Catalogue and Samples.
SAMSON CORDAGE WORKS, BOSTON, MASS.

TUNG-SOL

All Tungsol Miniature lamps are made to focus as recommended by the Society of Automobile Engineers.

Tungsol Miniature automobile lamps have this endorsement, combined with their reliability.

Miniature Lamp Works
Independent Lamp & Wire Co., Inc.
Weehawken, N. J.

COMRECO TRADE MARK

Platinum Contacts

Standard Sizes for Immediate Delivery

Manufactured By
The Commercial-Research Co.
Jackson Ave. & Honeywell St.
Long Island City
New York
Platinum—Silver—Tungsten—Molybdenum Specialties

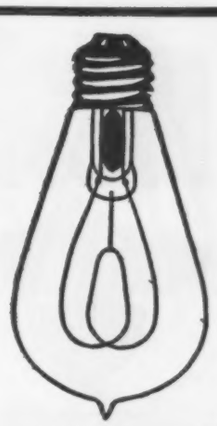
The
COAL & IRON NATIONAL BANK
143 Liberty Street
New York

CAPITAL	SURPLUS & PROFITS (EARNED)
$1,000,000.00	$613,106.79

Increased Profits

result from Lamp purchases at the

Consolidated Electric Lamp Company
Tapleyville Station, Danvers, Mass.



7157 2

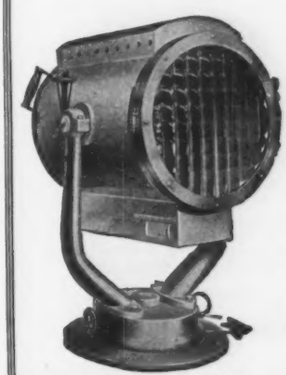
Best Grade Renewed Lamps

Both Carbon and Tungsten Types
We guarantee you most for the money
BOSTON-ECONOMY LAMP DIVISION
National Lamp Works of General Electric Co.
128 MAPLE ST. DANVERS, MASS.

Hygrade Tungsten Lamps

Hygrade

American made-for the Best American Trade
HYGRADE LAMP CO SALEM MASS

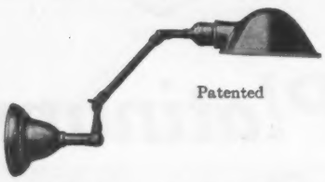


We are prepared to furnish
ELECTRIC SEARCH LIGHT PROJECTORS

for all commercial and Government service.
Any Candle power for motor boats, yachts and the largest steam vessels.
Send for catalog A.

The Carlisle & Finch Co.
228 E. Clifton Avenue
CINCINNATI, OHIO 3

Sells Quickly Because It's Really Practical



Patented

No. 1062-A extends 18 in. over all
No. 1062 extends 24 in. over all

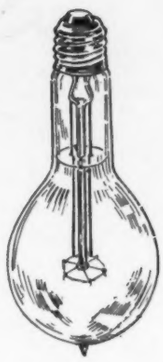
FARIES UNIVERSAL BRACKET LAMP

Not a toy, or a cheap novelty, but a really substantial and *thoroughly practical* article—a bracket lamp that you know will give lasting satisfaction to the user; sells at a moderate price and yields you a good profit.

Gets all the light just where wanted. A touch adjusts it—up or down, right or left. Carried in stock by leading jobbers. Order from the jobber who carries the goods in stock, that is his mission in life. If the jobber does not carry the goods in stock, send your order direct to the factory.

Faries Mfg. Co., Decatur, Ill.

TUNG-SOL
TUNG ARGOLYTE



New 50-Watt Nitrogen

The Argolyte 75-watt lamp has proved a distinct success.

The same quality factors assure a dependable 50-watt Argolyte.

Made in sizes up to 1000 watts.

Carried in stock for prompt shipment.

Write for discounts.

Independent Lamp & Wire Co., Inc.

Offices: 1733 Broadway, New York
Factory: Weehawken, N. J.

TRADE MARK

MOHRLITE

REGISTERED

Semi-Indirect

GOLD MEDAL AWARD SAN FRANCISCO 1915

The Mohrlite Co.
Urbana, Ohio

I-C

Controlling Devices

Automatic and hand operated Starters and Controllers for all conditions of service.

Industrial Controller Co.
MILWAUKEE

"Just Press a Button"

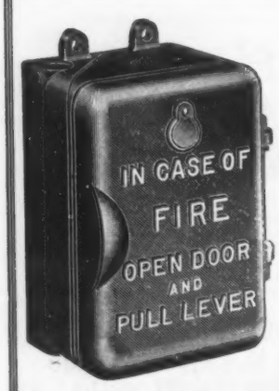
to start—stop—reverse—accelerate—decelerate

The Monitor System of automatic control for electric motor drive

Monitor Controller Company, 111 So. Gay Street, BALTIMORE

New York: Philadelphia: Chicago: Boston:

82-95



MESCO
TRADE MARK

Fire Alarm Boxes, Bells, Electro Mechanical Gongs, etc.,

conform to the requirements of the State Dept. of Labor, New York, and the Fire Prevention Bureau of New York City.

Ask for Circular.

Manhattan Electrical Supply Co.
New York, Chicago, St. Louis, San Francisco

TRADE MARK
C-A
WOOD PRESERVER
REGISTERED
U.S. PATENT OFFICE

THE CARBOLINEUM FAMINE IS NOW PASSED

We can Furnish 500,000 gallons and more

It is made in America—by Americans, and for Americans.

It is "C-A-WOOD-PRESERVER" (Carbolineum-America)—the only Wood Preserver sold with a *quality affidavit* guaranteeing you superiority.

C-A-WOOD-PRESERVER COMPANY, Inc.
St. Louis, Mo., 56 Liberty St., New York and Branches

EXCELLO

Flaming Arc Lamps the most efficient factory light—⅙ watt per C. P.

Kandem Electric Co., Inc., New York
29 East 21st Street

Secure the Co-operation of Our Designers and Engineers

in the campaign for better street lighting. Their specialized experience will prove a valuable adjunct to your service.

We will be pleased to submit designs and estimates on

Mott Lighting Standards

Address Ornamental Lamp Post Department.

The J. L. Mott Iron Works
Fifth Avenue and 17th St., New York City
2

The National Flag Campaign reaches Distant China

The fame of the great Flag Campaign and the prestige of "NATIONAL" *Electric Flags* has reached even distant China. From the faraway shores of the flowery kingdom comes an inquiry from parties interested in emulating for a foreign flag the electric glory of our own "Stars and Stripes."

"NATIONAL" *Electric Flags* are known the world over. Write for description and prices.

National Electric Sign Co.
Jersey City, N. J.

Convenient Sizes

LUX

40 and 60 Watt

NITROS

Other Sizes Up to 1500 Watts

Lux Manufacturing Co.
Hoboken, N. J.

New York Office.....1328 Broadway
Cleveland Office.....Jos. Phillips Co., 2114 W. 2d St.
Chicago Office .....1432 So. Michigan Ave.
St. Louis Office.....W. L. Rose, Pontiac Bldg.
Philadelphia Office.....47 North 13th St.
Western Coast Agents...Associated Manufacturers Importing Co., 993 Market St., San Francisco, Cal.

Your most particular customer

will be pleased with every detail of the

AutoMatic Washer

Her interest in this finest and most up-to-date of Washing Machines quickly develops into the desire for possession that means quick and easy sales for the Central Station or Electrical Goods Dealer.

Improved methods of doing the work combined with perfection in design, materials, workmanship and finish make an irresistible appeal to prospective customers.

Put it on your demonstration floor. Let the AUTOMATIC represent you for quality and efficiency. Read Bulletin 77.

Six models, all faultlessly made and elegantly finished.

Model 4

Automatic Electric Washer Co., Inc.
Newton, Iowa

1

Big sales from the word "go"

Three central stations who started in fall of 1915—each sold $10,000 worth of Hoovers before Jan. 1, 1916

Among the profit lessons to be learned from this experience are these: The opportunities for business on vacuum cleaners seems to be almost unlimited for the dealer who GOES *AFTER* THE BUSINESS with the right machine. But the greater lessons are:

THE HOOVER SUCTION SWEEPER

because of its greater superiority is easier to sell. It sells and makes good as no other cleaner can do, because it is the only machine that is designed to do THOROUGH WORK.

With its *electric*-driven brush, the Hoover makes effective the powerful suction. It sweeps up the clinging hair, threads and lint—it shakes to the surface the heavy, imbedded dirt—so that the rug or carpet is left not *half* clean, but *thoroughly* cleaned.

WRITE US. Find out for what a small investment you can handle the Hoover. Get our ideas on building vacuum cleaner business. No obligation incurred, and you'll get directly in touch with the livest proposition in the vacuum cleaner field.

The Hoover Suction Sweeper Co.
422 East Maple Avenue **New Berlin, Ohio**

Find out

THE HOOVER SUCTION SWEEPER CO.
000 East Maple Ave.,
New Berlin, O.

Gentlemen:—With the understanding that no obligation is incurred, kindly send me full particulars for your proposition to us.
[Use margin]

Firm name .....
Address .....
Your name .....

Give Current Use a Boost

Popularize its consumption in the churches by securing the installation of the

Kinetic Electric Blower

It will draw attention to the serviceability of electricity. It will give you a talking point for more wiring. It will further the "electricity" habit you are so anxious about.

We have strong "campaign literature" for the organists and clergymen of your town if you will give us their names. And we have an offer that will interest *You*.

Write us today.

Kinetic Engineering Co.
6018 Baltimore Ave., Philadelphia
Room 821, No. 41 Park Row, New York;
Room 8, No. 12 Pearl St., Boston;
1456 Monadnock Block, Chicago.

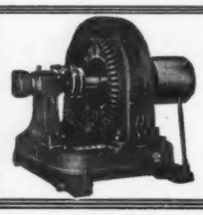
2414 1

SPARKING

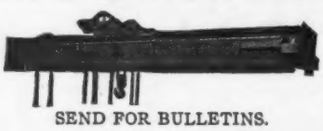
reduces the working capacity of a motor or dynamo, wears out the commutator, wastes power and may cause a fire.
All of this may be avoided if you use

The only article that will prevent sparking. Will keep the commutator in good condition and prevent cutting.
Absolutely will not gum the brushes.
It will put that high gloss on the commutator you have so long sought after

Send for Stick **50c PER STICK** **$5.00 PER DOZ.**
For Sale by all Supply Houses, or **K. McLennan & Co.** Sole Manufacturers
102 N. Fifth Ave., CHICAGO



Dependable—Efficient Electrical Machinery
Alternators
Synchronous Motors
Induction Motors
Switchboards
ELECTRIC MACHINERY CO.
Minneapolis, Minn. 3



ELECTRIC CRANES
HAND CRANES
ELECTRIC HOISTS
I-BEAM TROLLEYS

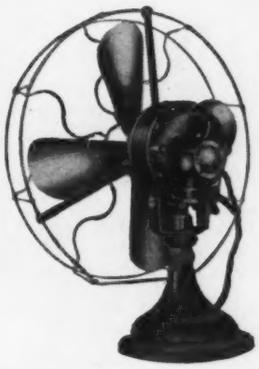
SEND FOR BULLETINS.

MARIS BROS., Philadelphia

The standard

Century

OSCILLATING FANS



make 4 complete oscillations per minute; more frequent oscillation prevents putting in motion a body of air which would be effective at distant points.

Should they oscillate into contact with a stationary object, an automatic ratchet device prevents damage to the fan.

Prices and Bulletins on request

CENTURY ELECTRIC CO.

19th, Pine to Olive Sts., St. Louis, Mo., U. S. A.

Sales Offices in Principal Cities

(219)

"NORMA"

BALL
ROLLER
THRUST
COMBINATION

THE NORMA COMPANY
OF AMERICA

1790 BROADWAY
NEW YORK

Storage Batteries

for Vehicles, Train Lighting, Isolated Plants, Ignition, Starting and Lighting

GIB

GENERAL LEAD BATTERIES COMPANY

CARL STREET AND LESTER AVENUE
NEWARK, N.J.

Get Our Proposition

The

MASTER GARAGE PUMP

provides—"Air on Tap"
at a moment's notice—
That's what private garage owners want—
That's what is necessary in big public garages.

Tires Must Be Kept

properly inflated—up to the prescribed pressure—Car owners won't wait—The air must be "on tap."
The Master Garage pump will properly inflate tires to the specified pressure—very rapidly—
No storage tank is required.
There is a Master Model designed for every garage requirement.
The minute the current is turned on The Master begins to deliver a *steady* stream of pure air—
free from oil—and *from any pulsation*
Can be connected in a moment's time to an electric circuit—
It requires only the switching of an electric button to start a steady stream of pure clean air—

SELL MASTER PUMPS

Tell your customers to use them 10 days—and guarantee them thus—

"We guarantee Master Garage Pumps for one year against defects of material or workmanship. With ordinary care and usage they should last 10 years."

We Will Back You

Note these models and send for details of the complete line.

Master Model W—Portable

Model W—Either Portable or Stationary

Simple, compact, powerful, substantial. Designed to stand severe service in Medium to Large Sized Public Garages.
Consists of a sturdy, efficient, two cylinder pump (bore, 1¾", stroke 2") driven by a ½ H.P. General Electric motor, mounted on a neat metal truck. Running at normal speed (500 R.P.M.) this machine will deliver three cubic feet of free air per minute or will completely inflate a 37" x 5" tire from flat to 90 lbs. pressure in less than 1½ minutes.
The cut shows outfit mounted on a truck with wheels and handle, but if preferred it can be mounted on a stationary base at the same price, and where desired makes a very satisfactory outfit to use in connection with a stationary tank installation.

Net price complete, either portable or stationary type,
With regular alternating current motor..... $105.00
With regular direct current motor..... 100.00
F.O.B. Hartford.

Model P—portable or stationary—
For *Private and small* public garages

Equipment is as shown by cut and includes 20 feet of air hose with pressure gauge and 20 feet of lamp cord with plug.
½ H.P. General Electric Motors used.
There is no installation expense.
It is only necessary to connect the motor with any ordinary electric light circuit by means of the lamp cord and plug which are furnished. No tank is required and the pump delivers pure air in a steady stream directly to the tires.
Completely inflates a 37 x 5 tire from flat to 90 lbs. in 2¾ minutes.

Net Price Complete.
With regular alternating current motor..... $60.00
With regular direct current motor..... 55.00

Master Model P—Stationary

Model P—on truck portable—

For use in public garages and large private garages this outfit may be mounted on a neat metal truck with wheels and handle.

Net Prices:
With regular alternating current motor $65.00
With regular direct current motor... 60.00
F.O.B. HARTFORD.

The proposition covering the sale of these pumps is alluring. Write for complete details—literature and special discounts to agents.

Master Garage Pumps

Manufactured and guaranteed by

Hartford Machine Screw Co.

490 Capitol Avenue, Hartford, Conn.

The "Ironclad-Exide" Battery for Industrial Trucks

A big demand has recently arisen for storage battery industrial trucks and tractors for use in freight terminals, on wharves, in industrial plants, etc. These trucks very materially increase the speed with which merchandise can be handled and greatly reduce the cost of moving such material.

The "Ironclad-Exide" Battery is specially adapted for use in these trucks. It is the battery of long life, that gives a reliable every-day service, that requires very little attention and that stands continuous hard service.

If you are interested we will send you a list of the prominent truck manufacturers and special literature on the "Ironclad-Exide" Battery for this service.

THE ELECTRIC STORAGE BATTERY CO.

NEW YORK BOSTON ROCHESTER PHILADELPHIA, PA. PITTSBURGH CHICAGO DENVER DETROIT
ST. LOUIS ATLANTA CLEVELAND 1888-1916 WASHINGTON SAN FRANCISCO TORONTO

HAYWARD

Write for Catalogue 42

It goes into details about the handling of materials—quickly and economically—with the Hayward Electric Motor Bucket.

THE HAYWARD CO. 1
50 Church Street, New York

ELECTRIC MOTOR BUCKET

7 to 1 Speed Range C & C MOTORS

By field control with a direct connected **C & C Motor**, and we can even give you 30 to 1 speed range if you want it. Also specially designed machine tool reversing motors, or any special motor to meet your requirements. We build Type S L Motors in all sizes, in the open, semi-enclosed and totally-enclosed types. Enclosed C & C Motors are dust-proof and water-proof.

Don't buy a motor at random. Do it right. Put your proposition up to our Engineering Department. At any rate, write today for our Bulletin E 1001.

RELIABILITY
C & C ELECTRIC & MFG. CO.
GARWOOD, N. J.

Branches in all Principal Cities.
New York Chicago Boston Philadelphia 129

MARTIN
Rotary Converter

for charging Storage Batteries under the constant Potential Method

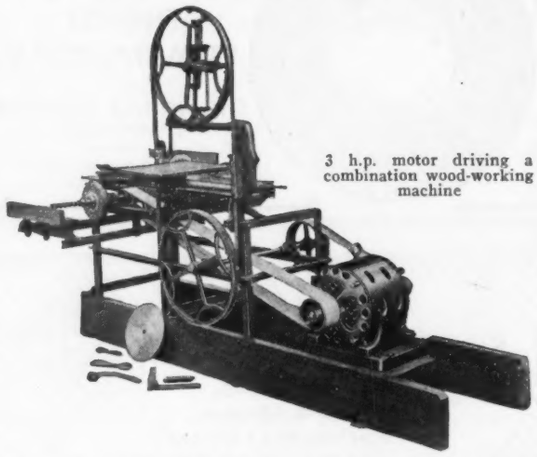
Write for full particulars

Northwestern Electric Co.
611-615 W. Adams St., Chicago, Ill.
New York, 1457 Broadway
Montreal, Quebec, 216 Bishop Street
Toronto, Ontario { 308 Tyrrell Bldg. / 95 King Street, E.

The sliding short circuiting contact actuated by centrifugal force and the fact that the brushes and commutator on

Century

SINGLE PHASE MOTORS



3 h.p. motor driving a combination wood-working machine

are in service only while starting causes them to give continued satisfactory results even when operating under the unfavorable conditions encountered in a woodworking shop.

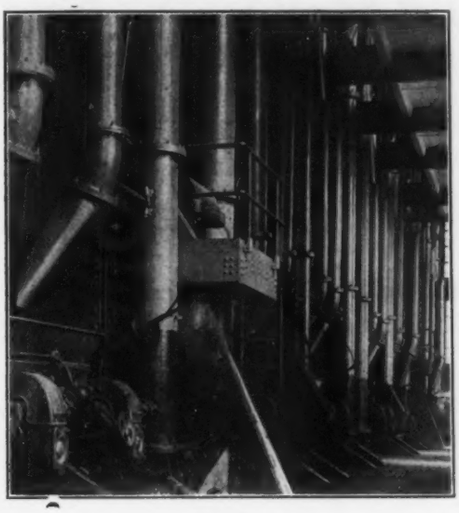
1/10 to 30 H.P.—25 to 140 CYCLES

CENTURY ELECTRIC COMPANY
19th, PINE to OLIVE STREETS, ST. LOUIS, MO.

Sales Offices in Principal Cities

(200)

Get "the other fellow's" stoker story



Many power plants now TAYLOR stokered arrived at their present state of stokering efficiency only after expensive experiments with other stokers.

Not only did these plants by experience become convinced of the superior efficiency of the TAYLOR,

But—

—they found its superiority great enough to warrant the expense of scrapping their original stoker and installing

The Taylor Stoker

When you can get your experience at the expense of some one else **it is folly to insist on paying for your own experience.**

There are a lot of TAYLOR Stokered plants practically identical with yours who will tell you *why* they chose the TAYLOR.

It's up to you to "cash in" on their experience. It may prevent you from ultimately "losing out" in getting your own.

Either experience or investigation can teach you that

—underfeeding

—mechanical control

and gravity cleaning

—are the essential principles of stokering efficiency. It will be cheaper for you to learn by *investigation* rather than experience that it pays to

"Install the Taylor Stoker in the first place"

American Engineering Co., Philadelphia

Your *Own* Electrical World

These are the advantages of being a personal subscriber:

You receive your own copy of Electrical World each week.
You have it when you want it and as long as you want it.
You can keep your own file of the paper for reference.

If you are not a regular subscriber, you probably see the Electrical World from time to time. **But,** are there not times—and many of them—when you want to read the latest issue and some one else has it? Are there not many other times when you want to refer to an article in a back number, but cannot find that number?

For less than 6 cents a week

you can be a personal subscriber—you can get all the news of the electrical field while it is still fresh and valuable—you can have a constantly growing library of your own on all branches of electrical work.

You will never miss the subscription price, but you will miss a lot of things if you do not get the World.

Better Send Your Order To-Day

before it is forgotten

ELECTRICAL WORLD
239 West 39th Street, New York .....

You may enter my subscription for the Electrical World to begin at once.

Cross out one of these lines } I enclose $.....herewith.
I agree to send $.....not later than.....
(Please give definite date)

Signed by .....

Address copies to.....

Street Address .....

City .....State .....

Company .....Position .....

Business of Company.....

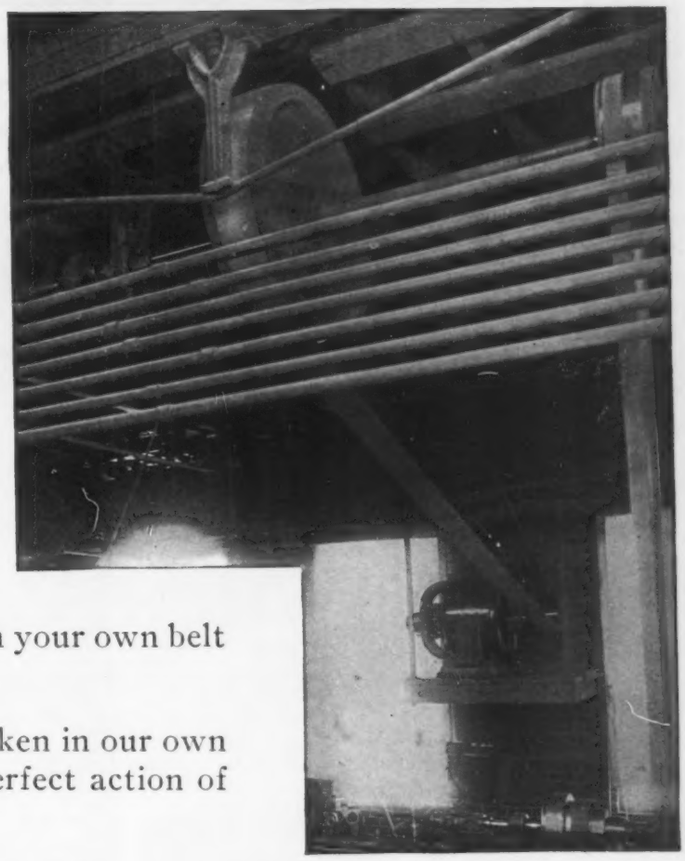
Yearly subscription rates: Domestic $3.00, Canadian $4.50, Foreign $6.00

E.W. 6-24-16

Two Seconds'—Time Exposure—with Flash

Belt Running 31½ Feet per Second

Photo Has Not Been Retouched



Compare this drive with your own belt drives.

The photograph was taken in our own shops. It shows the perfect action of belts when run on

Rockwood Paper Pulleys

If you could cut your present slip losses in half and double the life of your belts would you consider the difference worth while? Rockwood Paper Pulleys would do it for you—and more

They Are the Perfect Pulleys for Belt Drives

You are safe in buying them today—Twenty-five years of continued satisfactory service has proven their worth.

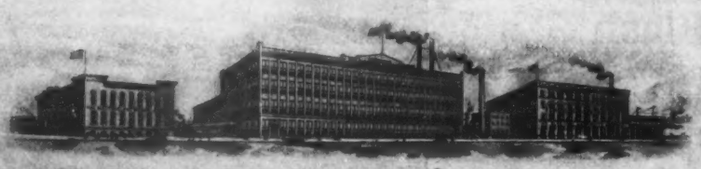
They Have Stood the Test of Time

Specify a Rockwood Paper Pulley for your next motor or generator—All electrical manufacturers supply them.

The Rockwood Manufacturing Company

Indianapolis, Indiana, U. S. A.

Another Tribute to "Doehler" Quality and Service.



THE ELECTRIC AUTO-LITE COMPANY
TOLEDO, OHIO

December 15th, 1915.

Doehler Die Casting Co.,
Brooklyn, New York.

Attention H. H. Doehler, President.

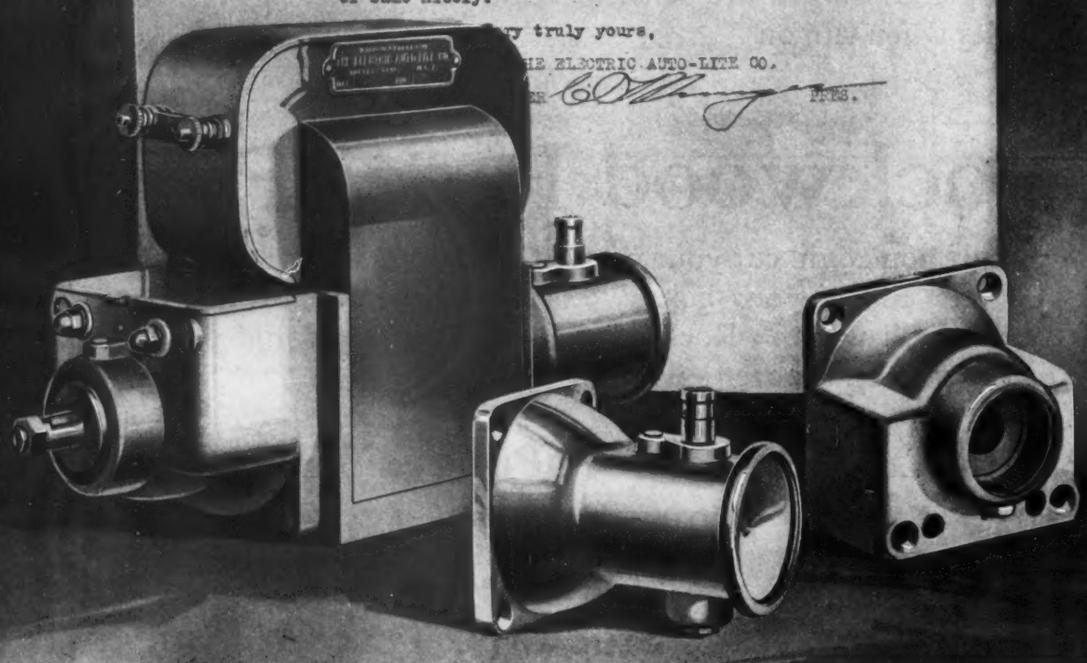
Gentlemen:-

We wish to take this opportunity to advise you how satisfactorily you have taken care of our requirements in die castings, during the year. The quality of the castings has been excellent, and your service in the way of prompt deliveries has been the same. As you know, our requirements for the year 1916 will be nearly double that of this year, and we feel that you will take care of same nicely.

...y truly yours,

...HE ELECTRIC AUTO-LITE CO.

...R ...Pres.



DOEHLER DIE-CASTING CO.

BROOKLYN, N.Y. TOLEDO, OHIO.

MOTORS, GENERATORS, TRANSFORMERS - IN ALL SIZES, IN ALL TYPES, FOR ALL PURPOSES

LIKE THE PYRAMIDS BUILT TO LAST

Motors, Generators and Transformers, in All Sizes, in All Types for All Purposes

Excellency

The Result of Knowledge and Experience

Twenty-eight years' experience in the design and construction of electrical machinery! This is the record of the Crocker-Wheeler Company who were pioneers in the electrical field.

Form H Direct-Current Motor—25 to 225 H.P.

During this period every detail of design, every factor of operation and every field of application have been studied by the Company's exceptional engineering talent.

Three presidents of the American Institute of Electrical Engineers were supplied by the Crocker-Wheeler Company. The founders of the Company were among the first to advocate and to appreciate the advantages of motor drive. It is engineering talent of this caliber that has applied and is applying the knowledge gained through the Company's long experience.

It is engineering talent of this caliber that is at your service in the solving of problems electrical.

Write for Bulletins

CROCKER-WHEELER

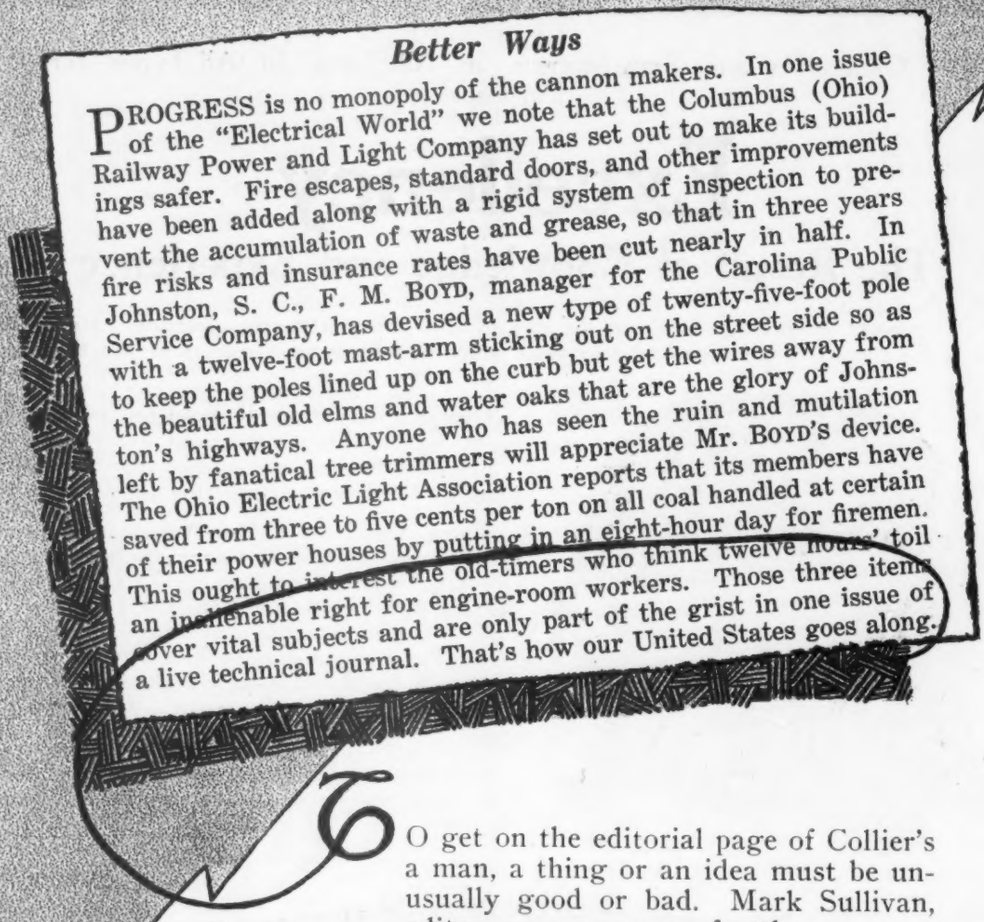
BALTIMORE CINCINNATI
BIRMINGHAM CLEVELAND
BOSTON DENVER
CHICAGO DETROIT

COMPANY
AMPERE, N.J.

NEW HAVEN PITTSBURG
NEWARK ST. PAUL
NEW YORK SAN FRANCISCO
PHILADELPHIA SYRACUSE

STURDY LITTLE MOTORS THAT WITHSTAND THE LAYMAN'S ABUSE

From the Editorial Page of Collier's — the National Weekly



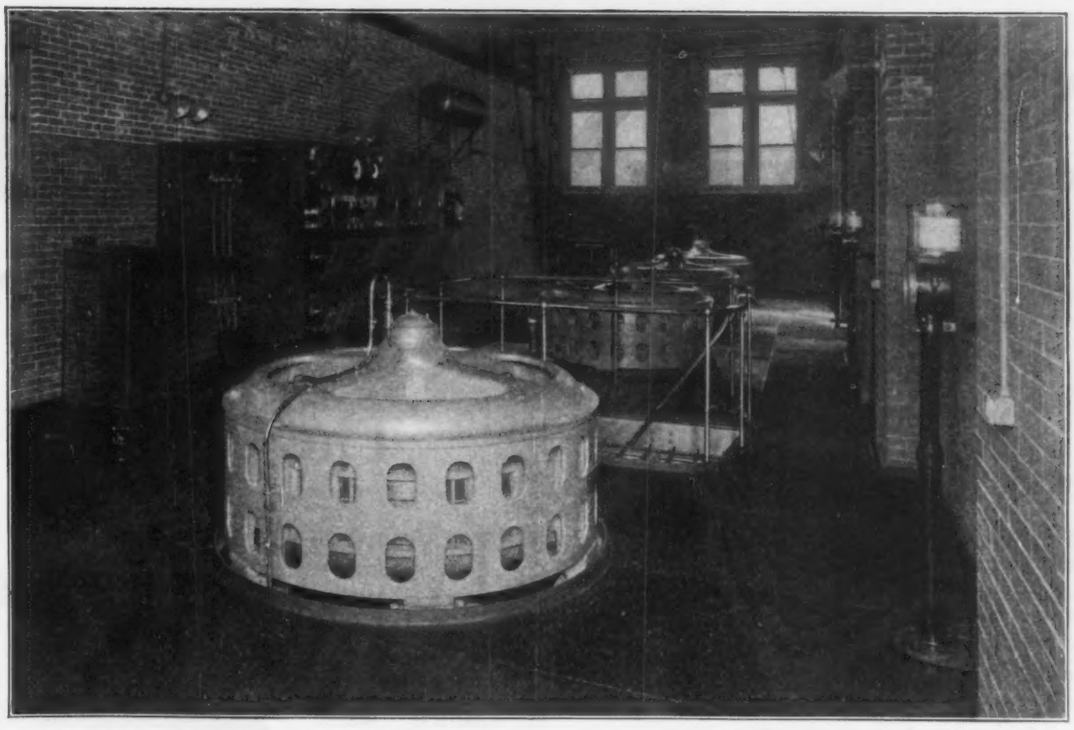
Better Ways

PROGRESS is no monopoly of the cannon makers. In one issue of the "Electrical World" we note that the Columbus (Ohio) Railway Power and Light Company has set out to make its buildings safer. Fire escapes, standard doors, and other improvements have been added along with a rigid system of inspection to prevent the accumulation of waste and grease, so that in three years fire risks and insurance rates have been cut nearly in half. In Johnston, S. C., F. M. BOYD, manager for the Carolina Public Service Company, has devised a new type of twenty-five-foot pole with a twelve-foot mast-arm sticking out on the street side so as to keep the poles lined up on the curb but get the wires away from the beautiful old elms and water oaks that are the glory of Johnston's highways. Anyone who has seen the ruin and mutilation left by fanatical tree trimmers will appreciate Mr. BOYD'S device. The Ohio Electric Light Association reports that its members have saved from three to five cents per ton on all coal handled at certain of their power houses by putting in an eight-hour day for firemen. This ought to interest the old-timers who think twelve hours' toil an inalienable right for engine-room workers. Those three items cover vital subjects and are only part of the grist in one issue of a live technical journal. That's how our United States goes along.

TO get on the editorial page of Collier's a man, a thing or an idea must be unusually good or bad. Mark Sullivan, editor, runs no corner for the commonplace.

Neither love, money, push nor pull will extract comment, but real merit will win favorable observation.

Electrical World is just naturally pleased to republish Collier's comment because it comes from an authority whose point of observation is a long way from the bull pen.



THIS MUNICIPAL SEWAGE-PUMPING STATION

in the city of Boston

is said to be

The Largest Automatic Sewage-Pumping Station in the World

The station is entirely automatic in operation, the four motor driven pumping units being started in succession as the sewage rises in the intake chamber. The smaller unit is started first, and if not sufficient to care for the volume, one of the larger units comes into operation for each 3-in. rise in the chamber. As the sewage is lowered the pumps are stopped in reverse order. The station, which has a total capacity of 105,000 gallons per minute, handles the flood water in the South End district of the city.

Allis-Chalmers Vertical Induction Motors

are used for each of the pumping units, the equipment consisting of three 150 H.P. 200 R.P.M. and one 75 H.P. 240 R.P.M. motors, wound for 440 volts, three-phase, 60 cycles.

This is but one of the many important municipal plants where Allis-Chalmers Motors are exclusively used.

ALLIS-CHALMERS MANUFACTURING COMPANY

General Offices: Milwaukee, Wisconsin

Sales Offices in All Principal Cities

Canadian Representatives: Canadian Allis-Chalmers, Ltd., Toronto, Ontario

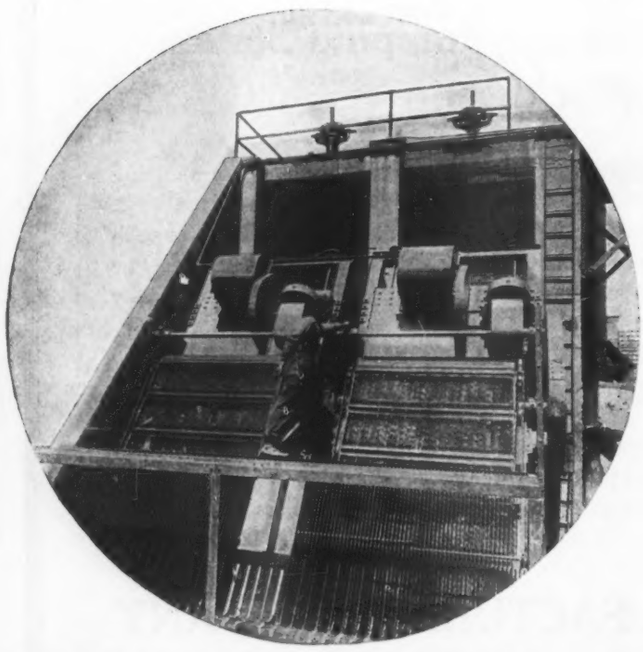
CHAIN-BELT

CHAIN BELT

TRAVELING WATER SCREENS

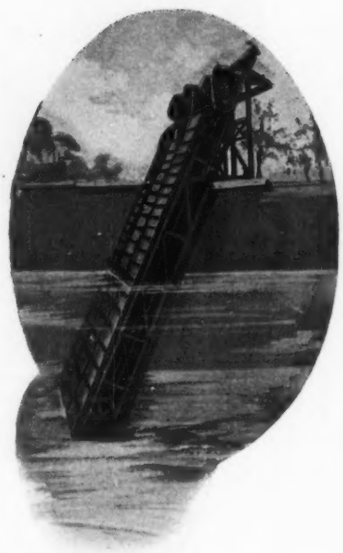
Some Power Plants That Use Them

Commonwealth Edison Co.....Chicago, Ill.
Edison Illuminating Co.....Detroit, Mich.
Milwaukee Electric Railway & Light Co .....Milwaukee, Wis.
Wisconsin Gas & Electric Co.....Milwaukee, Wis.
Cleveland Construction Co.....Cleveland, Ohio
Corrigan, McKinney & Co.....Cleveland, Ohio
Central Iowa Light & Power Co..Boone, Iowa
Counties Gas & Electric Co.....Philadelphia, Pa.
Morgan & Wright Co.....Detroit, Mich.



Chain Belt Traveling Water Screens in Operation at Fort Worth Power & Light Co., Fort Worth, Tex.

The Original



IN Chain Belt Traveling Water Screens you find the latest development in mechanical water screens. More than that—*they are* the economical solution of the problem.

Woven wire screens attached to two strands of Bronze Bushed CHABELCO Steel Chain Belt remove all foreign matter from the water, carrying over the top of the screen frame to the back, where automatic water sprays sluice it into a trough.

A small waterproof motor supplies the power. *The entire action is automatic and hand labor is eliminated.*

Many central stations have ended their intake water troubles by installing these screens. Our engineers are ready to help you obtain a satisfactory solution to yours. Send for data on design and existing installations.

CHAIN BELT CO.

720 Park St. Milwaukee, Wis.

CHAIN-BELT

One of the Leading Experts on Gears in the United States says:

"Smooth starting and stopping is effected on gears upon which CRATER COMPOUND has been applied, and I note that they are quieter."

Smooth operation means decreased wear.
Reduction of noise means decreased wear.
To save wear is to save the gears.

TEXACO CRATER COMPOUND
SAVES THE GEARS

SAVE THE GEARS

Write for the CRATER BOOK. It tells concisely how CRATER Saves the gears, how it adheres to metal surfaces, how it resists water, foreign matter and chemical vapors.

The book briefly sketches the performance of this wear-checking, corrosion-resisting lubricant in various industries. It contains photographs showing CRATER in use.

Note.—Texaco Crater Compound is but one of the many lubricants we make—each one designed to meet a certain set of mechanical conditions—an oil for every purpose—each one the right oil for the purpose.

THE TEXAS COMPANY

TEXACO

Department "L 4", 17 Battery Place, N. Y.

Houston **New York**

TEXACO

BRANCH OFFICES

Boston, Atlanta, Norfolk, Philadelphia
Dallas, Youngstown, Birmingham
El Paso, Chicago, Oklahoma City
St. Louis, New Orleans, Denver

What Advertisers Offer to Readers

Classified Index of Products of Representative Manufacturers and Dealers Advertising in This Issue

Air Compressors.
Allis-Chalmers Mfg. Co.
General Electric Co.
Platt Iron Works.
Worthington Pump & Machinery Corp.

Air Washers & Coolers.
Spray Engrg. Co.

Alarms, Low Water.
Erie Pump & Equipment Co.

Aluminum.
Aluminum Co. of America.

Ammeters, Voltmeters.
(See Instruments, Electrical.)

Anchors, Guy.
Hubbard & Co.
Matthews & Bro., Inc., W. N.

Annunciators.
Ostrander & Co., W. R.

Asbestos, Wood.
Johns-Manville Co., H. W.

Automobiles, Gasoline.
Packard Motor Truck Co.

Batteries, Dry Cell.
American Ever Ready Works.
Johns-Manville Co., H. W.
Philadelphia Elec. Co., Supply Dept.
Western Elec. Co.

Batteries, Primary.
Manhattan Electrical Supply Co.

Batteries, Storage.
Edison Storage Battery Co.
Electric Storage Battery Co.
General Lead Batteries Co.

Battery Connections.
Fahnestock Electric Co.

Bearings, Ball.
Hess-Bright Mfg. Co.
Norma Co. of America.
S K F Ball Bearing Co.

Bells.
Kandem Elec. Co., Inc.
Manhattan Elec'l Supply Co.
Ostrander & Co., W. R.

Binding Posts.
Fahnestock Electric Co.

Blowers, Electric.
Kinetic Engrg. Co.

Boilers.
Babcock & Wilcox Co.
Edgemoor Iron Co.

Bolts, Expansion.
Hubbard & Co.

Bond Testers.
Roller-Smith Co.

Books, Technical.
McGraw-Hill Book Co., Inc.

Boosters.
C & C Elec. & Mfg. Co.
Crocker-Wheeler Co.
General Electric Co.
Ridgway Dynamo & Engine Co.
Triumph Elec. Co.
Westinghouse Elec. & Mfg. Co.

Boxes, Fuse.
Electric Fuseguard Co
G & W Electric Specialty Co.
General Electric Co.
Johns-Manville Co., H. W.
Matthews & Bro., Inc., W. N.
Metropolitan Eng'g Co.

Boxes, Junction and Outlet.
Chicago Fuse Mfg. Co.
D & W Fuse Co.
Electric Fuseguard Co.
G & W Electric Specialty Co.
General Electric Co.
Johns-Manville Co., H. W.
Sprague Electric Works.

Boxes, Meter and Service.
Johns-Manville Co., H. W.
Metropolitan Eng'g Co.

Brackets and Pins, Metal.
Hubbard & Co.
Pittsburgh Transformer Co.

Brushes, Dynamo.
General Electric Co.
Jeandron, W. J.
Morgan Crucible Co., Ltd.

Brushes, Metal Spray.
Metals Coating Co. of America.

Buildings, Steel.
Blaw Steel Cons. Co.

Buckets, Excavating Motor-Driven.
Hayward Co.

Bus Bar Supports.
Royal Elec. Mfg. Co.

Bushings.
Condit Electrical Mfg. Co.
Diamond State Fibre Co.
National Fibre & Insulation Co.

Cable End Bells.
Elec'l Engineers Equip. Co.
G & W Electric Specialty Co.

Cable Racks.
Cope, T. J.
Hubbard & Co.
Metropolitan Eng'g Co.

Cable Splicing Joints.
Frankel Connector Co., Inc.
Matthews & Bro., Inc., W. N.

Cabling Machinery.
American Ins. Machinery Co.
New England Butt Co.
Torrington Mfg. Co.

Carbon Brushes.
Morgan Crucible Co., Ltd.

Castings.
Pittsburgh Valve, F. & C. Co.
Triumph Elec. Co.

Castings, Die.
Acme Die Casting Co.
Dohler Die Casting Co.

Chandeliers.
Benjamin Elec. Mfg. Co.

Circuit Breakers.
Condit Electrical Mfg. Co.
Cutter Co., The.
General Electric Co.
Industrial Controller Co.
Roller-Smith Co.
Sangamo Elec. Co.
Ward Leonard Electric Co.
Westinghouse Elec. & Mfg. Co.

Clamps, Ground Connections.
Belden Mfg. Co.
Frankel Connector Co., Inc.
General Electric Co.

Clamps, Guy.
Hubbard & Co.
Matthews & Bro., Inc., W. N.
Steel City Electric Co.

Clamps, Insulator.
Hatch, Edwin G.

Cleats.
Blake Signal & Mfg. Co.
Colonial Sign & Ins. Co.
General Electric Co.
Imperial Porcelain Co.
Pass & Seymour, Inc.
Thomas & Sons Co., R.

Climbers.
Klein Sons, Mathias.

Clips, Cable.
Hubbard & Co.

Clusters.
Benjamin Electric Mfg. Co.
Federal Sign System Elec.
Hubbell, Inc., Harvey.

Coal and Ash Handling Machinery.
Hayward Co.

Coils, Armature, Field.
D & W Fuse Co.
General Electric Co.
Independent Lamp & Wire Co.

Coils, Choke.
General Electric Co.
Royal Elec. Mfg. Co.

Commutators.
Cameron Electric Mfg. Co.

Commutators, Truing.
Jordan Bros., Inc.

Compounds, Commutator.
McLellan Co., K.

Condensers.
Platt Iron Works.

Conduit Bends.
Fibre Conduit Co.

Conduit Rods.
Cope, T. J.

Conduit Fittings.
Sprague Electric Works.
Pass & Seymour, Inc.

Conduits, Interior.
American Circular Loom Co.
Sprague Electric Works.
Tubular Woven Fabric Co.

Conduits, Underground.
Fibre Conduit Co.
Gest, G. M.
Johns-Manville Co., H. W.

Connectors and Terminals.
Elec'l Engineers Equip. Co.
Frankel Connector Co., Inc.

Controllers, Feed Water.
Erie Pump & Equipment Co.

Controllers, Motor.
Crocker-Wheeler Co.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
General Electric Co.
Industrial Controller Co.
Monitor Controller Co.
Ward Leonard Electric Co.
Westinghouse Elec. & Mfg. Co.

Conveying Machinery. (Coal, Ashes, Etc.)
Chain Belt Co.
Green Engineering Co.

Cooling Ponds, Spray.
Spray Engrg. Co.

Cord Adjusters.
American Vul. Fibre Co.
Diamond State Fibre Co.
National Fibre & Insulation Co.

Cord, Arc Lamp.
Samson Cordage Works.

Cord, Flexible.
American Electrical Works.
Belden Mfg. Co.
General Electric Co.
Rome Wire Co.

Cord, Trolley.
Samson Cordage Works.

Couplings, Flexible.
Bruce-Macbeth Engine Co.

Couplings, Magnetic.
Cutler-Hammer Mfg. Co.

Crane, Motors.
Crocker-Wheeler Co.
Sprague Electric Works.
Triumph Elec. Co.
Westinghouse Elec. & Mfg. Co.

Cranes, Traveling.
Maris Bros.

Cross Arms.
Hubbard & Co.
Thomas & Sons Co., R.
Western Elec. Co.

Cutouts.
D & W Fuse Co.
G & W Electric Specialty Co.
Matthews & Bros., Inc., W. N.
Metropolitan Eng'g Co.

Drills, Brick.
Hubbard & Co.

Dynamos and Motors.
Allis-Chalmers Mfg. Co.
Burke Elec. Co.
C & C Elec. & Mfg. Co.
Century Electric Co.
Crocker-Wheeler Co.
Electric Machinery Co.
Electro-Dynamic Co.
Emerson Electric Mfg. Co.
General Electric Co.
Gregory Electric Co.
Kimble Electric Co.
Northwestern Elec. Co.
Peerless Elec. Co.
Reliance Elec. & Eng. Co.
Ridgway Dynamo & Engine Co.
Robbins & Myers Co.
Sprague Electric Works.
Wagner Electric Mfg. Co.
Western Elec. Co.
Westinghouse Elec. & Mfg. Co.

Electromagnets.
Acme Wire Co.
Cutler-Hammer Mfg. Co.
Elec. Controller & Mfg. Co.
Sundh Electric Co.
Ward Leonard Elec. Co.

Engineers, Consulting and Contracting.
(See also Directory of Engineers.)

Engines, Gas and Gasoline.
Allis-Chalmers Mfg. Co.
Bruce-Macbeth Engine Co.
Carlisle & Finch Co.
General Electric Co.
Worthington Pump & Machinery Corp.

Engines, Oil.
Busch-Sulzer Bros., Diesel Engine Co.
Chicago Pneumatic Tool Co.
McIntosh & Seymour Corp.
Worthington Pump & Machinery Corp.

Engines, Steam.
Allis-Chalmers Mfg. Co.
McIntosh & Seymour Corp.
Ridgway Dynamo & Engine Co.

Excavating Machinery, Motor-Driven.
Hayward Co.

Experimental Apparatus.
Biddle, James G.
Leeds & Northrup Co.
Roller-Smith Co.

Fan Motors.
Adams-Bagnall Electric Co.
Century Elec. Co.
Crocker-Wheeler Co.
Emerson Electric Mfg. Co.
General Electric Co.
Kandem Elec. Co., Inc.
Peerless Elec. Co.
Robbins & Myers Co.
Sprague Electric Works.
Western Elec. Co.
Westinghouse Elec. & Mfg. Co.

Fans (Exhaust and Ventilating).
Adams-Bagnall Electric Co.
Crocker-Wheeler Co.
Emerson Elec. Mfg. Co.
Kimble Elec. Co.
Robbins & Myers Co.
Sprague Electric Works.
Westinghouse Elec. & Mfg. Co.

Fault Finders, Cable.
Lundin Elec. & Machine Co.
Matthews & Bros., Inc., W. N.

Fibre.
American Vul. Fibre Co.
Continental Fibre Co.
Diamond State Fibre Co.
Fibre Conduit Co.
Johns-Manville Co., H. W.
National Fibre & Insulation Co.

Field Coil Pads.
Mechanical Rubber Co.

Filters, Oil.
Richardson-Phenix Co.

Financial.
Coal & Iron National Bank.
Electric Bond & Share Co.

Fixtures, Electric and Gas.
Adams-Bagnall Electric Co.
Benjamin Elec. Mfg. Co.
Faries Mfg. Co.
Federal Sign System, Elec.
Johns-Manville Co., H. W.
Kandem Elec. Co., Inc.

Flashers.
Campbell Electric Co.

Flashlights.
American Ever Ready Works.

Friction Tape and Cloths.
Johns-Manville Co., H. W.
Mechanical Rubber Co.

Fuses.
Chicago Fuse Mfg. Co.
Condit Electrical Mfg. Co.
D & W Fuse Co.
Daum Co., A. F.
Delta Star Elec. Co.
Economy Fuse & Mfg. Co.
Electric Fuseguard Co.
General Electric Co.
Johns-Manville Co., H. W.
Kandem Elec. Co., Inc.
Metropolitan Eng'g Co.
Multi-Refillable Fuse Co.
Railway & Industrial Engrg. Co.
Schweitzer & Conrad, Inc.
Western Elec. Co.

What Advertisers Offer to Readers

Classified Index of Products of Representative Manufacturers and Dealers Advertising in This Issue

Fuses, Refillable.
Daum Co., A. F.
Economy Fuse & Mfg. Co.
Electric Fuseguard Co.
Johns-Manville Co., H. W.
Multi-Refillable Fuse Co.

Fuse Boxes.
(See Boxes, Fuse.)

Gages, Recording.
Bristol Co.
Foxboro Co., The.

Gages, Water Column.
Jenkins Bros.

Gas Meters, Electric.
Cutler-Hammer Mfg. Co.

Gears.
Diamond State Fibre Co.
New Process Gear Corp.

Gear Shift, Electric.
Cutler-Hammer Mfg. Co.

Globes, Shades, Etc.
Adams-Bagnall Electric Co.
Faries Mfg. Co.

Governors, Pump.
Erie Pump & Equipment Co.

Governors, Pump Speed.
Erie Pump & Equipment Co.

Grounds, Etc.
Paragon Elec. Co.

Guards, Inc., Lamp.
Hubbell, Inc., Harvey.
Matthews & Bro., Inc., W. N.

Hair Dryers.
Shelton Elec Co.

Hangers, Cable.
Condit Electrical Mfg. Co.
Hubbard & Co.

Head Gate Hoists.
Dayton Globe Iron Works.

Heaters, Feed Water.
National Pipe Bending Co.
Platt Iron Works.

Heating Devices, Electric.
Cutler-Hammer Mfg. Co.
General Electric Co.
Kandem Elec. Co., Inc.
Western Elec. Co.
Westinghouse Elec. & Mfg. Co.

Heating, Steam.
American District Steam Co.

Hoists, Electrical and Steam.
Allis-Chalmers Mfg. Co.
Maris Bros.
Sprague Electric Works.

Hydraulic Machinery.
Platt Iron Works.

Ice Machines.
Carbondale Mch., Co.

Igniters, Gas Engine.
Carlisle & Finch Co.

Indicators Sight Feed Oil.
Richardson-Phenix Co.

Indicators, Speed.
Biddle, James G.
Roller-Smith Co.

Injectors.
Jenkins Bros.

Instrument Transformers.
Weston Electrical Instrument Co.

Instruments, Electrical.
Graphic.
Biddle, James G.
Bristol Co.
Esterline Co.
General Electric Co.
Keystone Electrical Inst. Co.
Sangamo Elec. Co.
Westinghouse Elec. & Mfg. Co.
Indicating.
General Electric Co.
Keystone Electrical Inst. Co.
Pignolet, L. M.
Roller-Smith Co.
Wagner Elec. Mfg. Co.
Westinghouse Elec. & Mfg. Co.
Weston Electrical Inst. Co.
Integrating.
Biddle, James G.
Duncan Electric Mfg. Co.
Federal Sign System Elec.
General Electric Co.
Roller-Smith Co.
Sangamo Electric Co.
Westinghouse Elec. & Mfg. Co.
Scientific and Testing.
Biddle, James G.
Esterline Co.
General Electric Co.
Keystone Electrical Inst. Co.
Leeds & Northrup Co.
Matthews & Bro., Inc., W. N.
Metropolitan Eng'g Co.
Roller-Smith Co.
Western Electro Mechanical Co.

Insulating Machinery.
American Ins. Machinery Co.
New England Butt Co.

Insulating Material.
China and Porcelain.
Colonial Sign & Ins. Co.
Imperial Porcelain Works.
Locke Insulator Mfg. Co.
Ohio Brass Co.
Pittsburgh H. V. Ins. Co.
Thomas & Sons Co., R.
Compounds, Paints and Varnishes.
Condensite Co. of America.
Diamond State Fibre Co.
Dickinson Mfg. Co.
General Bakelite Co.
General Electric Co.
Hemming Mfg. Co.
Irvington Varnish & Insulator Co.
Mechanical Rubber Co.
Mica Insulator Co.
Packard Elec. Co.
Standard Paint Co
Sterling Varnish Co.
Composition Cloth and Paper.
Diamond State Fibre Co.
Irvington Varnish & Insulator Co.
Mechanical Rubber Co.
Mica Insulator Co.
Mitchell-Rand Mfg. Co.
Fibre.
Amer. Vulcanized Fibre Co.
Continental Fibre Co.
Diamond State Fibre Co.
Johns-Manville Co., H. W.
Lava.
Steward Mfg. Co., D. M.
Mica.
Mica Insulator Co.
Tar-Heel Mica Co.

Silk.
Irvington Varnish & Insulator Co.
Tape.
Diamond State Fibre Co.
Johns-Manville Co., H. W.
Mechanical Rubber Co.
Mica Insulator Co.
Mitchell-Rand Mfg Co.
Packard Elec. Co.
Standard Woven Fabric Co.

Insulating Cement.
Mechanical Rubber Co.

Insulating Paper.
Diamond State Fibre Co.
Irvington Varnish & Insulator Co.
Johns-Manville Co., H. W.
National Fibre & Insulation Co.

Insulators.
China, Porcelain and Composition.
Colonial Sign & Ins. Co.
Imperial Porcelain Works.
Johns-Manville Co., H. W.
Locke Insulator Mfg. Co.
Mica Insulator Co.
Ohio Brass Co.
Pittsburg High Volt. Ins. Co.
Thomas & Sons Co., R.
Glass.
Brookfield Glass Co.
Hemingray Glass Co.
Locke Insulator Mfg. Co.

Insulator Clamps.
Elec'l Engineers Equip. Co.

Insulator Pins.
Hubbard & Co.
Thomas & Sons Co., R.

Intake Screens, Traveling.
Chain Belt Co.

Lamp Locks.
Pass & Seymour, Inc.

Lamps, Arc.
Adams-Bagnall Electric Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Lamps, Flaming Arc.
General Electric Co.
Kandem Elec Co., Inc.
Westinghouse Elec. & Mfg. Co.

Lamps, Incandescent.
Boston Economy Lamp Div.
Consolidated Elec. Lamp Co.
General Electric Co.
Hygrade Lamp Co.
Independent Lamp & Wire Co.
Johns-Manville Co., H. W.
Lux Mfg. Co.
Philadelphia Elec. Co., Supply Dept.
Western Elec. Co.
Westinghouse Lamp Co.

Lamps, Miniature.
General Electric Co.

Lamps, Portable.
Faries Mfg. Co.

Lamp, Replacers.
Matthews & Bro., Inc., W. N.

Lava.
(See Insulating Material, Lava.)

Lighting Companies.
Commonwealth Edison Co.

Lightning Arresters.
Delta Star Elec. Co.
General Electric Co.
Hubbard & Co.
Railway & Industrial Engrg. Co.
Schweitzer & Conrad, Inc.
Westinghouse Elec. & Mfg. Co.

Line Material.
Anderson Mfg. Co., A. & J. M.
Archbold-Brady Co.
Elec'l Engineers Equip. Co.
G & W Elec. Specialty Co.
General Electric Co.
Hubbard & Co.
Johns-Manville Co., H. W.
Matthews & Bro., Inc., W. N.
Ohio Brass Co.
Western Elec. Co.
Westinghouse Elec. & Mfg. Co

Linemen's Tools.
(See Tools, Linemen.)

Linemen's Shields.
Linemen Protector Co.
Matthews & Bro., Inc., W. N.

Lubricant, Hydraulic Governor.
Crew Levick Co.

Lubricant, Hydraulic Turbine.
Crew Levick Co.

Lubricating Oils.
Texas Co.

Lubricators.
Richardson-Phenix Co.

Machines, Armature Notching.
Ferracute Machine Co.

Machines, Billing.
Elliott Fisher Co.

Magnet Wire.
Acme Wire Co.
American Brass Co.
American Steel & Wire Co.
Belden Mfg. Co.
Benedict & Burnham Mfg. Co.
D & W Fuse Co.
General Electric Co
Independent Lamp & Wire Co.
Roebling's Sons Co., J. A.
Rome Wire Co.
Western Elec. Co.

Magnets.
Acme Wire Co.

Magnets, Lifting.
Cutler-Hammer Mfg. Co.
Elec. Controller & Mfg. Co.

Magnets, Permanent.
Esterline Co.

Mechanical Stokers.
Riley Stoker Co., Ltd., Sanford.

Medical Apparatus.
Manhattan Elec'l Supply Co.
Pignolet, L. M.

Meter Testers.
States Company.

Meters, Flow.
Spray Engineering Co.

Meters, Water.
Builders Iron Foundry.

Mica.
American Mineral Grinding Co.
Mica Insulator Co.
Tar-Heel Mica Co.

Mining Machinery.
Allis-Chalmers Mfg. Co.
Crocker-Wheeler Co.

Molded Insulations.
Cutler-Hammer Mfg. Co.
Dickinson Mfg. Co.
Johns-Manville Co., H. W.

Molybdenum Wire.
Commercial Research Co.

Motors.
(See Dynamos and Motors.)

Nippers and Pliers.
Klein & Sons, Mathias.

Novelties, Electric.
Carlisle & Finch Co.

Nozzles, Spray.
Spray Engineering Co.

Oiling Systems.
Richardson-Phenix Co.

Oils, Cylinder.
(See Lubricants.)

Oil, Lubricating.
Texas Co.

Oil, Transformer.
Texas Co.

Operators, Public Utilities.
Light & Development Co., St. Louis.

Packing.
Jenkins Bros.
Johns-Manville Co., H. W.

Panel Boards.
Adams-Bagnall Electric Co.
General Electric Co.
Trumbull Elec. Mfg. Co.
Westinghouse Elec. & Mfg. Co.

Penstock.
Portland Wood Pipe Co.

Photometric Apparatus.
Elec'l Testing Laboratories.
Leeds & Northrup Co.

Pinions, Rawhide.
New Process Gear Corp.

Pipe.
Portland Wood Pipe Co.

Pipe (Riveted Steel).
Schweitzer & Conrad, Inc.

Plating Apparatus, Metal Spray.
Metals Coating Co. of America.

Platinum.
Baker & Co., Inc.

Plugs.
Condit Electrical Mfg. Co.
Cutler-Hammer Mfg. Co.
Hubbell, Inc., Harvey.
Pass & Seymour, Inc.

Pole Erectors.
Matthews & Bro., Inc., W. N.

Pole Line Hardware.
Hubbard & Co.
Matthews & Bro., Inc., W. N.
Steel City Elec. Co.
Western Elec. Co.

Poles, Arc Lamp.
Mott Iron Works, J. L.

Poles, Brackets, Pins, Etc.
Western Elec. Co.

Poles, Cedar.
Northern White Cedar Assn.

Poles, Re-Enforcing.
Hubbard & Co.

Poles, Steel.
Archbold-Brady Co.
Blaw Steel Cons. Co.
Carbo Corp.
Coombs, R. D.
Western Elec. Co.

Poles and Ties, Wood.
Carney & Co., B. J.

Porcelain. (See Insulating Material, China and Porcelain.)

Posts, Arc Lamp.
Lundin Elec. & Machine Co.

Potentiometers.
Biddle, James G.
General Electric Co.
Leeds & Northrup Co.

Potheads.
Colonial Sign & Insulator Co.
Elec'l Engineers Equip. Co.
G & W Elec. Specialty Co.
Okonite Co., The.

Protective Devices.
General Electric Co.
Metropolitan Eng'g Co.
Schweitzer & Conrad, Inc.

Pulleys.
Rockwood Mfg. Co.

Pumps, Air.
Platt Iron Works.
Worthington Pump & Machinery Corp.

Pumps, Centrifugal.
Allis-Chalmers Mfg. Co.
Platt Iron Works.

Pumps, Electric, Garage.
Hartford Machine Screw Co.

Pumps, House Elec.
Columbus Pump Supply Co.

Pumps, Motor Driven.
Fort Wayne Engrg. & Mfg. Co.
Kinetic Engrg. Co.
Pelton Waterwheel Co.
Platt Iron Works.

Pumps, Oil.
Platt Iron Works.
Richardson-Phenix Co.
Worthington Pump and Machinery Corp.

Pumps, Steam Driven.
Allis-Chalmers Mfg. Co.
Platt Iron Works.
Worthington Pump & Machinery Corp.

Pumps, Vacuum.
Platt Iron Works.
Worthington Pump & Machinery Corp.

What Advertisers Offer to Readers

Classified Index of Products of Representative Manufacturers and Dealers Advertising in This Issue

Pumps, Water Works.
Pelton Waterwheel Co.
Platt Iron Works.

Push Buttons.
Manhattan Elec'l Supply Co.

Pyrometers.
Bristol Co., The.
Esterline Co.
Keystone Electrical Inst. Co.
Leeds & Northrup Co.

Rail Bonds.
American Steel & Wire Co.
Condit Electrical Mfg. Co.
General Electric Co.

Railways, Miniature.
Carlisle & Finch Co.

Ranges, Elec.
Cutler-Hammer Mfg. Co.
General Electric Co.

Receptacles. (See Sockets.)

Receptacles, Sign.
Federal Sign System, Elec.

Rectifiers.
General Electric Co.

Regulators, Feed Water.
Erie Pump & Equipment Co.

Reflectors.
Adams-Bagnall Electric Co.
General Electric Co.
Johns-Manville Co., H. W.

Refrigerating Machines.
Carbondale Machine Co.

Regulators, Feed Water.
Erie Pump & Equipment Co.

Regulators, Pump.
Erie Pump & Equipment Co.

Repairing.
Gregory Electric Co.

Resistance Units.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
General Electric Co.
Industrial Controller Co.
Ward Leonard Electric Co.

Resistance Wire.
(See Wires, Resistance.)

Rheostats.
Biddle, James G.
Campbell Electric Co.
Crocker-Wheeler Co.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
General Electric Co.
Industrial Controller Co.
Monitor Controller Co.
Sundh Electric Co.
Ward Leonard Elec. Co.
Westinghouse Elec. & Mfg. Co.

Rosettes.
General Electric Co.
Hart Mfg. Co.
Pass & Seymour, Inc.

Rubber Covered Wire.
Roebling's Sons Co., J. A.

Searchlights.
Carlisle & Finch Co.
Esterline Co.
General Electric Co.

Second-hand Apparatus.
Algona Steel Corp., Ltd.
Archer & Baldwin.
Gregory Electric Co.
Jordan Bros., Inc.
MacGovern & Co.
Missouri Gas & Elec. Service Co.
Power Machinery Exchange, Inc.
Plainville Mill & Elevator Co.
Price, R. T.
Randle Machinery Co.
Scheinert Co., R.
Wilson Machinery Co., H. R.

Separators, Magnetic.
Cutler-Hammer Mfg. Co.

Shade Holders.
Adams-Bagnall Electric Co.
General Electric Co.
Hubbell, Inc., Harvey.

Shades, Tin.
Ostrander & Co., W. R.

Sheet Metal.
American Sheet & Tin Plate Co.

Sheets, Electrical.
American Sheet & Tin Plate Co.

Shovels, Pole Hole.
Matthews & Bros., Inc., W. N.

Signs.
Colonial Sign & Ins. Co.
Federal Sign System, Elec.

Signs, Electric.
Colonial Sign & Ins. Co.
National Elec. Sign Co.
Johns-Manville Co., H. W.

Sign Letters.
Federal Sign System, Elec.

Slate.
Portland-Monson Slate Co.

Sleeves, Splicing.
Hatch, Edwin G.

Sleeving, Braided.
Belden Mfg. Co.

Sockets and Receptacles.
Benjamin Elec. Mfg. Co.
Cutler-Hammer Mfg. Co.
Federal Sign System, Elec.
General Electric Co.
Hart Mfg. Co.
Hubbell, Inc., Harvey.
Johns-Manville Co., H. W.
Kandem Elec. Co., Inc.
Ostrander & Co., W. R.
Pass & Seymour, Inc.

Sockets, Turndown.
General Electric Co.
Pass & Seymour, Inc.

Solder.
Belden Mfg. Co.

Soldering Flux.
Blake Signal & Mfg. Co.
Condit Electrical Mfg. Co.

Soldering Irons.
General Electric Co.

Solenoids.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
General Electric Co.
Industrial Controller Co.
Sundh Electric Co.
Ward Leonard Electric Co.

Soot Cleaners, Boiler.
Vulcan Soot Cleaner Co.

Special Machinery.
Torrington Mfg. Co.

Speedometers.
Keystone Elec'l Inst. Co.

Splicing Compounds.
Mechanical Rubber Co.

Splicing Sleeves.
Frankel Connector Co., Inc.

Springs.
American Steel & Wire Co.
Cary Spring Works.
Cook Spring Co.

Stage Lighting Apparatus.
Campbell Electric Co.
Condit Electrical Mfg. Co.

Staples.
American Steel & Wire Co.
Blake Signal & Mfg. Co.

Starters, Motor.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
General Electric Co.
Ward Leonard Elec. Co.

Stokers.
American Engineering Co.
Edgemoor Iron Co.
Green Eng'g Co.
Riley Stoker Co., Ltd., Sanford.

Stoves, Electric. (See Ranges, Elec.)

Sub-Stations, Outdoor.
General Electric Co.
Transmission Engrg. Co.

Supplies (Electric Railway).
General Electric Co.
Johns-Manville Co., H. W.
Ohio Brass Co.
Western Elec. Co.

Supplies, Electrical.
General Electric Co.
Kandem Elec. Co., Inc.
Manhattan Elec. Supply Co.
Pass & Seymour, Inc.
Philadelphia Elec. Co. Supply Dept.
Western Elec. Co.

Switchboard Mats.
Mechanical Rubber Co.

Switchboard Supplies.
Condit Electrical Mfg. Co.
Elec'l Engineers Equip. Co.
General Electric Co.
Roller-Smith Co.
Westinghouse Elec. & Mfg. Co.

Switchboards.
Allis-Chalmers Mfg. Co.
Anderson Mfg. Co., A. & J. M.
Condit Electrical Mfg. Co.
General Electric Co.
Roller-Smith Co.
Triumph Elec. Co.
Trumbull Elec. Mfg. Co.
Wagner Elec. Mfg. Co.
Western Elec. Co.
Westinghouse Elec. & Mfg. Co.

Switches, Automatic Time.
Anderson Mfg. Co., A. & J. M.

Switches, Disconnecting.
Anderson Mfg. Co., A. & J. M.
Matthews & Bros., Inc., W. N.
Royal Elec. Mfg. Co.

Switches, Fuse.
General Electric Co.
Matthews & Bro., Inc., W. N.

Switches, Knife.
Anderson Mfg. Co., A. & J. M.
Condit Electrical Mfg. Co.
Cutter Co., The.
Electric Controller & Mfg. Co.
General Electric Co.
Metropolitan Eng'g Co.
Trumbull Elec. & Mfg. Co.
Westinghouse Elec. & Mfg. Co.

Switches, Oil.
Condit Electrical Mfg. Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Switches, Pole Top.
Delta-Star Elec. Co.
Elec'l Engineers Equip. Co.
General Electric Co.
K-P-F Elec. Co.
Railway & Industrial Engrg. Co.
Royal Elec. Mfg. Co.

Switches, Remote Control.
Anderson Mfg. Co., A. & J. M.
Cutler-Hammer Mfg. Co.
General Electric Co.
Hart Mfg. Co.
Sundh Elec. Co.

Switches, Series.
G & W Elec. Specialty Co.

Switches, Snap and Push Button.
Cutler-Hammer Mfg. Co.
General Electric Co.
Hart Mfg. Co.
Pass & Seymour, Inc.
Trumbull Elec. Mfg. Co.

Switches, Time.
Campbell Electric Co.
Paragon Electric Co.

Switches, Toggle.
Newton Mfg. Co.

Tachometers.
Biddle, James G.
Bristol Co., The.
Esterline Co.
Foxboro Co., The.
Keystone Elec'l Inst. Co.
Roller-Smith Co.

Taps and Dies.
Carpenter, Tap & Die Co., J. M.

Telephones.
Manhattan Elec'l Supply Co.
Western Elec. Co.

Testing Apparatus.
American Transformer Co.
Biddle, James G.
Esterline Co.
Keystone Electrical Inst. Co.
Leeds & Northrup Co.
Roller-Smith Co.

Testing Laboratories.
Elec. Testing Laboratories, Inc.
Leeds & Northrup Co.

Theatre Dimmers.
Cutler-Hammer Mfg. Co.
General Electric Co.
Industrial Controller Co.
Ward Leonard Electric Co.

Thermometers.
Bristol Co., The.
Foxboro Co., The.
Keystone Electrical Inst. Co.
Leeds & Northrup Co.

Tools, Construction.
Klein & Sons, Mathias.

Tools, Linemen's.
Klein & Sons, Mathias.
Western Elec. Co.

Tools, Portable Elec.
Chicago Pneumatic Tool Co.

Towers, Transmission.
Archbold-Brady Co.
Blaw Steel Cons. Co.
Coombs, R. D.
Transmission Eng'g Co.

Transformers.
Adams-Bagnall Electric Co.
Allis-Chalmers Mfg. Co.
American Transformer Co.
Campbell Electric Co.
Crocker-Wheeler Co.
Duncan Elec. Mfg. Co.
Enterprise Elec. Co.
Kuhlman Elec. Co.
Metropolitan Eng'g Co.
Moloney Elec. Co.
Packard Elec. Co.
Pittsburgh Transformer Co.
Triumph Electric Co.
Wagner Elec. Mfg. Co.
Westinghouse Elec. & Mfg. Co.
Weston Electrical Ins. Co.

Transformer, Bell Ringing.
General Electric Co.
Pittsburgh Transformer Co.
Westinghouse Elec. & Mfg. Co.

Trucks, Gasoline.
Packard Motor Car Co.

Turbines, Steam.
Allis-Chalmers Mfg. Co.
General Electric Co.
Kerr Turbine Co.
Ridgway Dynamo & Engine Co.

Typewriters, Adding.
Elliott-Fisher Co.

Vacuum Cleaners.
Hoover Suction Sweeper Co.
Western Elec. Co.

Valve Discs.
Diamond State Fibre Co.
Jenkins Bros.
Ohio Brass Co.

Valves.
Jenkins Bros.
Ohio Brass Co.
Pittsburgh Valve F. & C. Co.
Richardson-Phenix Co.
Sundh Electric Co.

Valves, Cylinder Relief.
Ludlow Valve Mfg. Co.

Valves, Pumps.
Chapman Valve Mfg. Co.
Jenkins Bros.

Valves, Regulating.
Erie Pump & Equipment Co.

Venturi Meters.
Builders Iron Foundry.

Vibrators.
Shelton Elec. Co.

Washing Machines, Electric.
American Woodenware Mfg. Co.
Automatic Elec. Washer Co.
Kandem Elec. Co., Inc.
Western Elec. Co.

Waterproofing.
Johns-Manville Co., H. W.
Mitchell-Rand Mfg. Co.

Water Metering Systems.
Builders Iron Foundry.

Water Wheels and Turbines.
Allis-Chalmers Mfg. Co.
Pelton Water Wheel Co.
Platt Iron Works.
Smith Co., S. Morgan.
Trump Mfg. Co.

Water Wheel Governors.
Pelton Waterwheel Co.
Woodward Governor Co.

Wattmeters, Watt-Hour Meters.
(See Instruments, Electrical.)

Weatherproof Wire.
Roebling's Sons Co., J. A.

Winding Machinery.
New England Butt Co.

Wire, Molybdenum.
Commercial Research Co.

Wires, Resistance.
Belden Mfg. Co.
Driver-Harris Wire Co.
Electrical Alloy Co.

Wires and Cables.
A A Wire Co., Inc.
Acme Wire Co.
Amer. Brass Co.
Amer. Electrical Works.
Amer. Steel & Wire Co.
Atlantic Ins. Wire & Cable Co.
Belden Mfg. Co.
Benedict & Burnham Mfg. Co.
Bridgeport Brass Co.
D & W Fuse Co.
Driver-Harris Wire Co.
General Electric Co.
Independent Lamp & Wire Co.
Indiana Rub. & Ins. Wire Co.
Kerite Ins. Wire & Cable Co.
Lowell Ins. Wire Co.
Moore, Alfred F.
New York Insulated Wire Co.
Okonite Company, The.
Packard Elec. Co.
Phillips Insulated Wire & Cable Co.
Roebling's Sons Co., J. A.
Rome Wire Co.
Safety Ins. Wire & Cable Co.
Simplex Wire & Cable Co.
Trumbull Elec. Mfg. Co.
Western Elec. Co.

Wood Pipe.
Portland Wood Pipe Co.

Wood Preserving.
C-A-Wood-Preserver Co.

X-Ray Apparatus.
Campbell Electric Co.

ALPHABETICAL INDEX TO ADVERTISEMENTS

NOTICE TO ADVERTISERS:

Printing begins on Friday of each week.
Changes of copy received up to 10 A. M. Saturday will appear in the issue of the following week, but no proofs can be submitted for OK before publication.
New Advertisements (not changes of copy) received up to Tuesday noon can appear in the issue of that week, but no proofs can be shown.
If proofs before printing are required changes of copy and copy for new advertisements must be in our hands two weeks in advance of the date of publication.

Abbott, Jr., W. G. 36
Acme Die Casting Co. 53
Acme Wire Co. 46
Adams-Bagnall Electric Co. 52
Algona Steel Corp., Ltd. 39, 40
Allis-Chalmers Mfg. Co. 81
Aluminum Co. of America. 44
American Brass Co. 45
American Circular Loom Co. 50
American District Steam Co. 36
American Electrical Works. ..... BC
American Engrg. Co. 75
American Eveready Works. 31
American Insulating Mach. Co. .. 44
American Mineral Grinding Co. .. 49
American Sheet & Tin Plate Co. 50
American Steel & Wire Co. 45
American Transformer Co. 52
American Vulcanized Fibre Co. .. 48
American Woodenware Mfg. Co. 67
Anderson Mfg. Co., A. & J. M. .. 54
Archbold-Brady Co. 56
Archer & Baldwin. 39
Arnold Co. 36
Atlantic Ins. Wire Cable Co. 45
Automatic Elec. Washer Co., Inc. 63

Babcock & Wilcox Co. 72
Baehr, William A. 36
Baker & Co., Inc. 46
Barstow & Co., W. S. 36
Belden Mfg. Co. 44
Benedict & Burnham Mfg. Co. .. 45
Benjamin Electric Co. 60
Biddle, James G. 59
Blake Signal & Mfg. Co. 48
Blaw Steel Const. Co. 54
Boston Economy Lamp Div. 61
Bridgeport Brass Co. ..... BC
Bristol Co. ..... BC
Brookfield Glass Co. 58
Bruce-Macbeth Engine Co. 73
Builder's Iron Foundry. 74
Burke Electric Co. 68
Busch-Sulzer Bros. Diesel Engine Co. 70
Byllesby & Co., H. M. 36

C-A-Wood Preserver Co., Inc. .. 62
C & C Elec. & Mfg. Co. 66
Cameron Electric Mfg. Co., The. 68
Campbell Electric Co. 55
Carbo Corp. 59
Carbondale Mch. Co. 71
Card Index 37
Carlisle & Finch Co., The. 61
Carney & Co., B. J. 46
Carpenter Tap & Die Co., J. M. . 54
Cary Spring Works. 51
Century Elec. Co. 65, 66
Chain Belt Co. 82
Chicago Fuse Mfg. Co. 57
Chicago Pneumatic Tool Co. 68
Clark, Walter G. 36
Coal & Iron National Bank. 61
Colonial Sign & Ins. Co. 57
Columbus Pump Supply Co. 72
Commercial Research Co. 61
Condensite Co. of America. 46
Condit Electrical Mfg. Co. 13
Consolidated Electric Lamp Co. . 61
Continental Fibre Co. 49
Cook Spring Co. 51
Coombs, R. D. 36
Cooper, Hugh L. 36
Cope, T. J. 53
Cravath, J. R. 36
Crew Levick Co. 30
Crocker-Wheeler Co. 79
Cutler-Hammer Mfg. Co. 9
Cutter Co., The. 30

D & W Fuse Co. 44
Daum & Co., A. F. 57
Day & Zimmermann. 36
Davton Globe Iron Works. 71
Delta Star Elec. Co. 56
Diamond State Fibre Co. 48
Dickinson Mfg. Co. 50
Directory of Engineers. 36, 37
Dodge, Kern 36
Doehler Die Casting Co. 78
Driver-Harris Wire Co. 45
Duncan Elec. & Mfg. Co. 10

Economy Fuse & Mfg. Co. 4
Edgemoor Iron Works. 71
Edison Storage Battery Co. 22
Electric Bond & Share Co. 56
Electric Controller & Mfg. Co. ... 54
Electric Fuseguard Co. 57
Electric Machinery Co. 64
Electric Storage Battery Co. 66
Electrical Alloy Co. 47
Electrical Engineers Equip. Co. . 47
Elec'l Testing Laboratories, Inc. 36, 60
Electrical World 3
Electro-Dynamic Co. 69
Elliott Fisher Co. 20
Emerson Elec. Mfg. Co. ..... BC
Engineers, Directory of. 36, 37
Erie Pump & Equipment Co. 70
Esterline Co. 21

Fahnestock Electric Co. 56
Fargo Engineering Co. 36
Faries Mfg. Co. 62
Federal Sign System, Electric. .. 18
Ferracute Machine Co. 72
Fibre Conduit Co. 53
Ford, Bacon & Davis. 36
Forstall & Robison. 36
Fowle, Frank F. 36
Foxboro Co., The. ..... BC
Frankel Connector Co., Inc. 51

G & W Elec. Spec. Co. 55
General Bakelite Co. 5
General Electric Co. 32, 33
General Lead Batteries Co. 65
Gest, G. M. 53
Graves Engineering Co., Inc. 36
Green Engineering Co. 70
Gregory Electric Co. 38

Hart Mfg. Co. 68
Hartford Machine Screw Co. 65
Hatch, E. G. 57
Hayward Co. 66
Hemming Mfg. Co. ..... BC
Hess-Bright Mfg. Co. 16
Hoover Suction Sweeper Co. 64
Hornung, John C. 36
Hubbard & Co. 17
Hubbell, Harvey, Inc. 14, 54
Hygrade Lamp Co. 61

Imperial Porcelain Works. 48
Independent Lamp & Wire Co., Inc. 61, 62
Indiana Rub. & Ins. Co. 34
Industrial Controller Co. 62
Irvington Varnish & Insulator Co. 49

Jackson, D. C. & W. B. 36
Jeandron, W. J. 72
Jenkins Bros ..... BC
Johns-Manville Co., H. W. 15
Jordan Bros., Inc. 69

K-P-F Electric Co. 55
Kandem Elec. Co., Inc. 62
Kerite Insulated Wire & Cable Co. 34
Kerr Turbine Co. 70
Keystone Elec'l Instrument Co. . 60
Kimble Electric Co. 69
Kinetic Engrg. Co. 64
Klein & Sons, Mathias. 46
Klein & Co., Inc., Nathan. 40
Kuhlman Elec. Co. 52

Le Carbone Co. 72
Leeds Northrup Co. 59
Light & Development Co. of St. Louis 36
Locke Insulator Mfg. Co. 58
Lowell Ins. Wire Co. 44
Lundin Elec. & Machine Co. 50
Lux Mfg. Co. 63

MacGovern & Co. 39
Manhattan Electrical Supply Co. . 62
Maris Bros. 64
Matthews & Bro., Inc., W. N. .... BC
McGraw-Hill Book Co., Inc. 35
McIntosh & Seymour Corp. 70
McLennan & Co., K. 64
McMeen & Miller. 36
Mead, Daniel W. 36
Mechanical Rubber Co. 49
Mershon, Ralph D. 36
Metals Coating Co. of America. . 29
Metropolitan Eng. Co. 31
Mica Insulator Co. 47
Missouri Gas & Elec. Service Co. 38
Mitchell-Rand Mfg. Co. 47
Mohrlite Co. 62
Moloney Electric Co. 52
Monitor Controller Co. 62
Moody Engineering Co. 36
Moore, Alfred F. 45
Moore & Co., W. E. 37
Morgan Crucible Co., Ltd. 28
Morse Bros. Machinery & Supply Co. 38
Mott Iron Works, J. L. 63
Multi-Refillable Fuse Co. ..... BC

National Electric Sign Co. 63
National Fibre & Insulation Co. . 47
National Pipe Bending Co. 69
Neall, N. J. 37
Neiler, Rich & Co. 37
New England Butt Co. 46
New Process Gear Corporation. . 52
Newton Mfg. Co. 29
New York Ins. Wire Co. ..... BC
Norma Co. of America. 65
Northern White Cedar Assn. 23
Northwestern Elec. Co. 66
Norton, Bird & Whitman. 37

Ohio Brass Co. 53
Okonite Co. 34
Ostrander & Co., W. R. 60

Packard Elec. Co. 67
Packard Motor Car Co. 6
Paragon Elec. Co. 55
Pass & Seymour, Inc. 19
Peerless Elec. Co. 11
Pelton Water Wheel Co. 73
Philadelphia Elec. Co. Supply Dept. 51
Phillips Insulated Wire & Cable Co. 44
Pignolet, L. M. 57
Pillsbury, Charles L. 37
Pittsburg High Voltage Ins. Co. . 58
Pittsburgh Transformer Co. 27
Pittsburgh Valve F. & C. Co. 72
Plainville Mill & Elevator Co. 40
Platt Iron Works. 72
Portland-Monson Slate Co. 50
Portland Wood Pipe Co. 71
Power Machinery Exchange, Inc. 38
Price, R. T. 39

Railway & Industrial Engrg. Co. 53
Randle Machinery Co. 38
Reed, W. Edgar. 37
Reliance Elec. & Eng. Co. 68
Richardson-Phenix Co. 73
Ridgway Dyn. & Eng. Co. 74
Riley Stoker Co., Sanford. 74
Robbins & Myers Co. 25
Rockwood Mfg. Co. 77
Roebling's Sons Co., John A. 46
Roller-Smith Co. 28
Rome Wire Co. ..... BC
Royal Elec. & Mfg. Co. 56

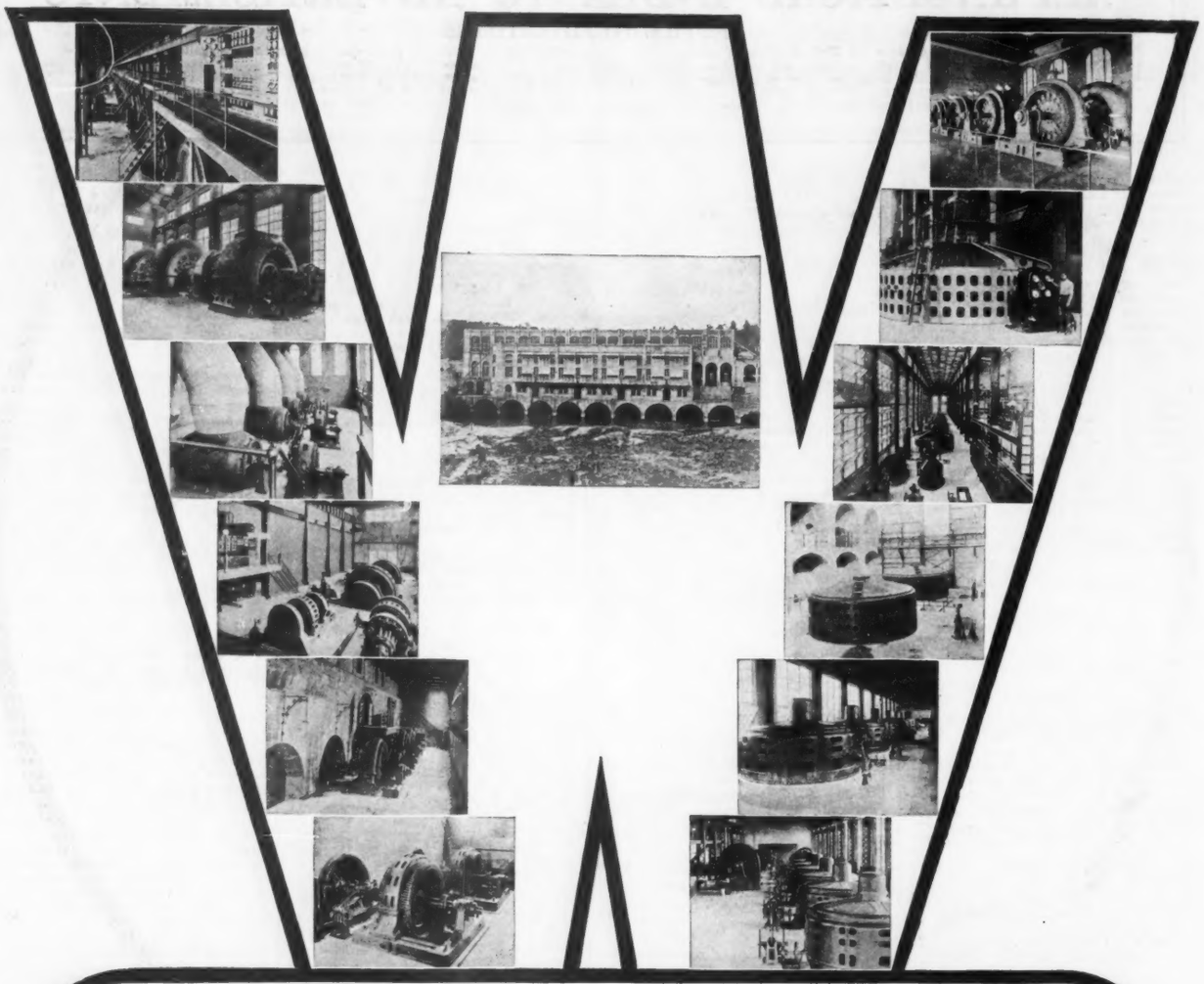
S K F Ball Bearing Co. 24
Safety Ins. Wire & Cable Co. ... 44
Samson Cordage Works. 60
Sanderson & Porter. 37
Sangamo Elec. Co. 60
Sargent & Lundy. 37
Scheidenhelm, F. W. 36
Scheinert Co., R. 39
Schweitzer & Conrad, Inc. 56
Scofield Eng'g Co. 37
Searchlight Section 38-43
Shelton Electric Co. 59
Simplex Wire & Cable Co. 34
Smith Co., S. Morgan. 73
Sprague Electric Works. 51
Spray Engineering Co. 70
Standard Paint Co. 50
Standard Woven Fabric Co. 49
States Company 59
Steel City Elec. Co. 8
Sterling Varnish Co. 50
Steward Mfg. Co., D. M. 48
Stone & Webster Eng'g Corp. 37
Sundh Electric Co. 56

Tar Heel Mica Co. 49
Taylor, John B. 37
Texas Co. 83
Thomas, Percy H. 37
Thomas & Sons Co., R. 57
Torrington Mfg. Co. 46
Transmission Engrg. Co. 53
Triumph Elec. Co. 69
Trumbull Electric Mfg. Co. 67
Trump Mfg. Co. 71
Tubular Woven Fabric Co. 7

Underwriters' Laboratories, Inc. 37

Vulcan Soot Cleaner Co. 26

Wagner Electric Mfg. Co. 54
Ward Leonard Elec. Co. 27
Western Electric Co. ..... FC
Western Electro-Mechanical Co. . 59
Westinghouse, Church, Kerr & Co. 37
Westinghouse Elec. & Mfg. Co., 88, 89, 90, 91
Weston Electrical Instrument Co. 2
White Companies, J. G. 37
Williams, Gardner S. 37
Wilson Machinery Co., H. R. 39
Woodmansee & Davidson. 37
Woodward Governor Co. 73
Worthington Pump & Machinery Corp. 70, 71



WESTINGHOUSE ELECTRIC

Water-Wheel Generators in any type, capacity and speed, as designed by experienced engineers, built of high-grade materials under expert supervision and inspection in the Westinghouse Shops, are Reliable, Efficient and Durable.

Westinghouse Electric & Manufacturing Co.

Sales Offices in All Large American Cities

East Pittsburgh Pennsylvania

334

Westinghouse

C O Relay

The Original Induction Relay
Precise—Simple—Reliable

Can be instantly and accurately adjusted to the desired time and current values.

It will isolate the defective circuits and insure continuity of service to the rest of the system.

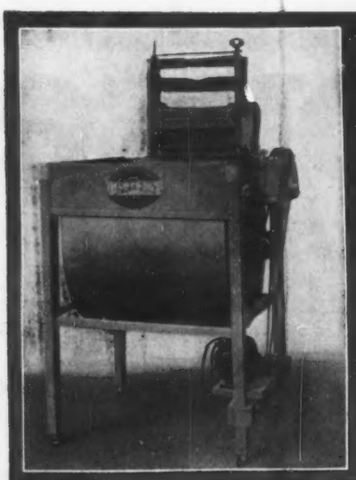
W
WESTINGHOUSE ELECTRIC

Our nearest office will gladly give further particulars

Westinghouse Electric & Manufacturing Co.
East Pittsburgh, Pa.

Atlanta, Ga.
Baltimore, Md.
Birmingham, Ala.
Bluefield, W. Va.
Boston, Mass.
Buffalo, N. Y.
Butte, Mont.
Charleston, W. Va.
Charlotte, N. C.
Chicago, Ill.
Cincinnati, Ohio
Cleveland, Ohio
Columbus Ohio
*Dallas, Texas
Dayton, Ohio
Denver, Colo.
Detroit, Mich.
*El Paso, Texas
*Houston, Texas
Indianapolis, Ind.
Joplin, Mo.
Kansas City, Mo.
Louisville, Ky.
Los Angeles, Cal.
Memphis, Tenn.
Milwaukee, Wis.
Minneapolis, Minn.
New Orleans, La.
New York, N. Y.
Omaha, Neb.
Philadelphia, Pa.
Pittsburgh, Pa.
Portland, Ore.
Rochester, N. Y.
St. Louis, Mo.
Salt Lake City, Utah
San Francisco, Cal.
Seattle, Wash.
Syracuse, N. Y.
Toledo, Ohio
Washington, D. C.

*W. E. & M. Co. of Texas. 335



Satisfied Users

are the best recommendations a motor driven washer can have.

Mr. Dealer and Central Station Manager, you can secure satisfied users by selling washing-machines equipped with

Westinghouse Splash-Proof Motors

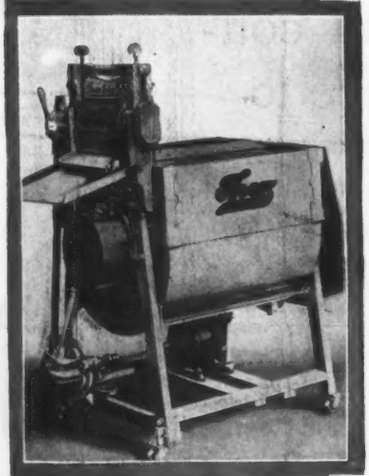
Their reliability is demonstrated by the number of different manufacturers of washing-machines who have adopted Westinghouse Motors as standard for their washers.

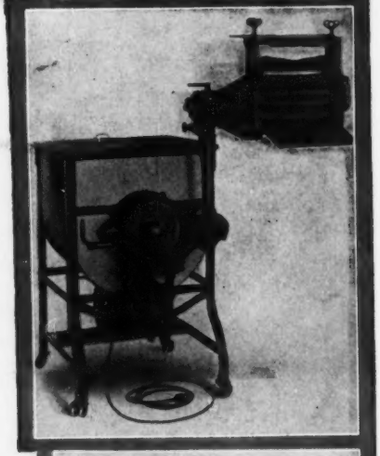
Have you seen "Small Motors" No. 25?

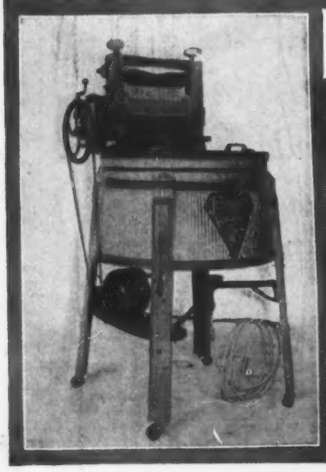
Westinghouse Electric & Mfg. Co.
East Pittsburgh, Pa.

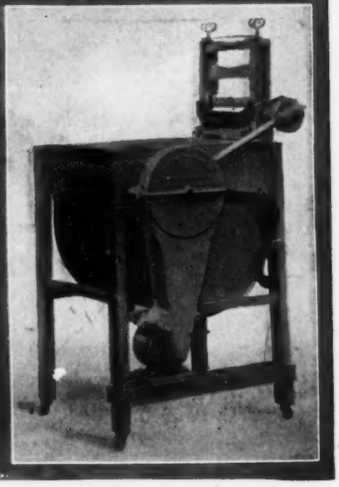
323

Sales Offices in all large American Cities







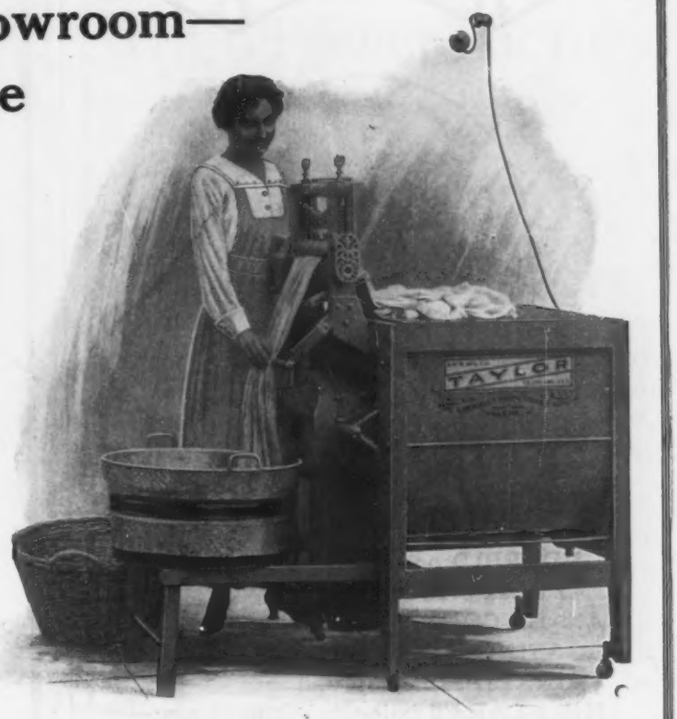


Attractive in the Showroom—Efficient in the Home

The TAYLOR *Electric Cylinder Washer* in workmanship and finish is as neat a piece of merchandise as you could place in your showroom. Its appearance appeals at once to the prospect. But not only does the

—ELECTRIC TAYLOR CYLINDER WASHER—

satisfy the appraising eye—it satisfies the practical demand of the user for a washer that really does wash all kinds of clothes thoroughly, quickly and economically. It's a good-looking machine and as good as it looks. Write for details.

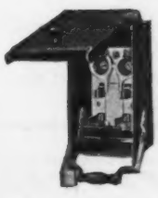


American Woodenware Mfg. Co., Toledo, Ohio

Ⓣ Combines Perfect Ⓣ Operating Simplicity with Absolute Safety

—a box-enclosed switch that absolutely prevents anyone from getting in touch with the live parts because when the switch is in contact the box has to be closed and is held closed by the handle. Also this handle acts as a lever which throws the switch. The

"Circle T" Combination Switch In Safety Box



is operated *entirely* from outside.

Can be locked and sealed open.

Box cannot be opened when the switch is in contact.

Can be had with or without quick break.

Write for full data.

The Trumbull Electric Mfg. Co.
Plainville, Conn.

New York Chicago Philadelphia San Francisco
Boston Buenos Aires London Barcelona

1

Packard

Transformer Service

Means two things—
Things of importance to you

First—that we hold some notable trade records for getting the goods to you. Second—Absolute dependability of performance.

Write for Bulletin E. W.

SALES AGENTS

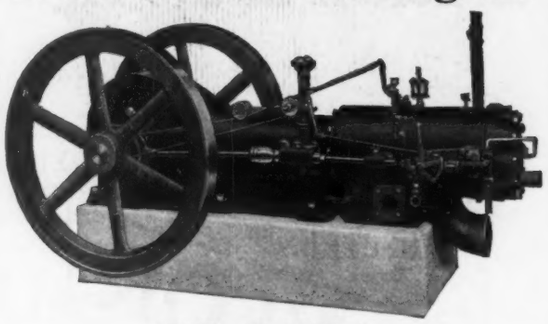
Electric Appliance Co., Chicago, Dallas, New Orleans and San Francisco.
Post Glover Electric Co., Cincinnati, Ohio.
H. I. Sackett Electric Co., Buffalo, N. Y.
Electric Service Supplies Co., Philadelphia, New York and Boston.
Braid Electric Co., Nashville, Tenn.
N.L. Walker, Raleigh, N. C.

The ***Packard Electric Company,*** WARREN, OHIO

THE ELECTRICAL Contractor
ON A wiring job
SAID "Looks as though I've
UNDERBID on this job.
IF I break even I'll be Lucky."
AN EX-CONTRACTOR
LOAFING around the job
SMIRKED as he adjusted
HIS 2-CARAT imitation diamond pin.
"I'LL SHOW YOU the way out.
SEND back those
'DIAMOND H' Switches and Receptacles
AND SLIP in Jitney Switches
INSTEAD—they may not last as long
BUT THEY'LL let you out."
THE WORKING contractor
NOT WISHING to give away any
OF HIS successful business policies
REPLIED "I guess you're right"
BUT under his breath he said
"YOU POOR deluded failure,
YOU DON'T realize yet
WHAT PUT you out of business.
YOU HAVEN'T learned
THAT MODERN business
IS BASED on confidence.
WHAT IF I don't make
DIRECT money on *this* job,
I'LL STILL be recognized
AS A GOOD contractor."
THE EX-CONTRACTOR
IS STILL ex-contracting.
HE DOESN'T know why—
BUT YOU do!

THE HART MANUFACTURING COMPANY
Hartford, Conn.

Reduce Your Power Cost
by Installing a
Giant Fuel Oil Engine



A-O Giant Fuel Oil Engine

For operating Pumps and Generators, Air Compressors and all Power Purposes.

GIANT FUEL OIL ENGINES

are made in capacities from 12 to 160 hp. and will operate successfully on

Crude Oil	Stove Oil	Diesol	Coal Oil
Fuel Oil	Star Oil	Solar Oil	Kerosene
Residuum	Calol	Gas Oil	

which means **Low Operating Cost.**

No valves, gears, carbureters, mixers, oil or air heaters, magnetos, batteries, timers, switches, coils, wires or spark plugs.

Write for Bulletins and Prices.

CHICAGO PNEUMATIC TOOL CO.
1044 Fisher Building, Chicago — **52 Vanderbilt Avenue, New York**
Branches Everywhere
A-10 2

MANUFACTURERS OF ELECTRICAL MACHINERY
MOTORS BURKE ELECTRIC GENERATORS COMPANY TRANSFORMERS
ERIE, PA.

MOTORS

For all purposes where reliable power is essential.

ALL SIZES ALL SPEEDS ALL VOLTAGES

Direct and 2 or 3 phase Alternating Current

BURKE ELECTRIC COMPANY
Works: Erie, Pa. **Sales Offices in Principal Cities**

Commutators and Commutator Segments

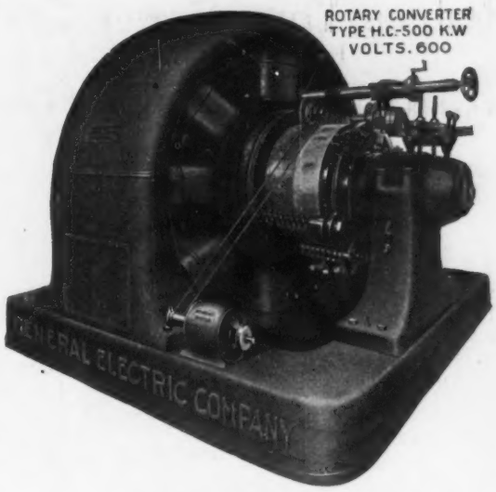
for Electric Starters and Lighters and all other types of D. C. Motors.

THE CAMERON ELECTRIC MFG. CO.
ANSONIA, CONN.

RELIANCE ADJUSTABLE SPEED MOTORS

Run at any speed with a constant horsepower output over any range up to 1 to 10.
No electric controller used.

Reliance Electric & Engineering Co.
1046 Ivanhoe Road Cleveland, O.



Office of W. H. Harvey, Manager

Winona Water, Sewerage, Ice and Light Co.

Jordan Bros.,
New York, N. Y.

Gentlemen: We received the truing device yesterday, used it to-day and it works beautifully. Find enclosed check for the amount of invoice.

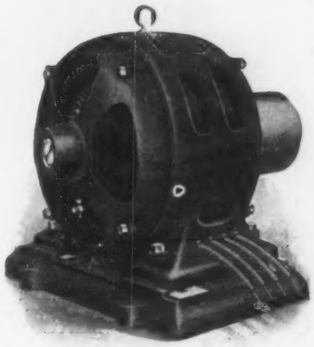
I beg to remain,
Yours very truly,
W. H. Harvey."

JORDAN BROTHERS, Inc., 80 Beekman Street, N. Y. City
41214 3

High Power Factors

and low temperature rise
are two of the reasons why

TRIUMPH Induction Motors



should be thoroughly investigated before your next purchase.

Triumph Bulletins contain a wealth of information on induction motors, and are yours upon request.

The Triumph Electric Co.

CINCINNATI OHIO

Branches in Principal Cities

Do not overlook the announcements that appear from week to week in the

Searchlight Section

Some of the offerings are real bargains and may be just what you need. Some of the needs may be for just what you can supply. Whenever you want to buy, sell, rent or exchange, consult the Searchlight Section of the World.

Get Your Wants into the Searchlight

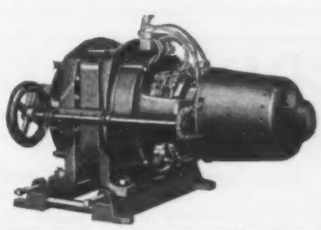
For cylinder and job presses

Give practically as complete, flexible control as can be secured from direct current.

First motors to do this. Thousands in use. Quick sellers and sure repeaters. Send for catalog and discounts.

Kimble Electric Co.
637 N. Western Avenue
Chicago, Ill.

KIMBLE
Variable Speed
Alternating Current
Printing Press
MOTORS



NATIONAL
DIRECT CONTACT
FEED WATER HEATERS
The National Pipe Bending Company
New Haven, Conn.

INTER-POLE MOTORS

For all electric drives. Constant or adjustable speed. Freedom from sparking. It's due to the INTER-POLES.

Bulletins mailed on request.

Electro-Dynamic Co., Bayonne, N. J.

Measure Your Feed Water As Carefully As You Weigh Your Coal

Know Just How Your Boiler Is Evaporating by Putting a

Worthington Hot Water Meter

in the boiler feed line. It is your only means of knowing whether you get the most out of your coal.

A Worthington Meter accurately measures hot feed water under pressure—has minimum bearing and wearing surfaces—is impervious to chemical action.

Bulletin W-167-38 tells all about it. Copy on request.

Worthington Pump and Machinery Corporation

Branch Offices in All Principal Cities

Works: Harrison, N. J.

New York Office: 115 Broadway W 318.4

Spraco Products

Cooling Ponds Air Washers

For cooler, cleaner air. For greater generator capacity.

Spray Engineering Co. Engineers Manufacturers

93 Federal St., Boston, Mass.

DO YOU KNOW ?

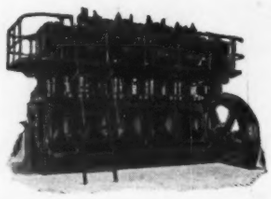
that you are not getting the most out of your boilers unless you use

The Copes Boiler Feed Regulator

Send for Catalog

Erie Pump & Equipment Co., Erie, Pa.

Diesel Engines



Our 15 years' experience is your guarantee. Over 150 per cent more horse power sold to Central Stations on re-orders than on initial orders. Send for bulletins.

Busch-Sulzer Bros.-Diesel Engine Company

St. Louis U. S. A.

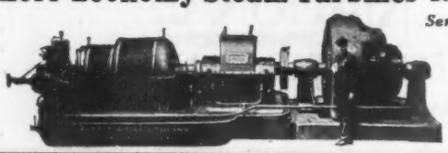
Minneapolis, 754 Plymouth Bldg., San Francisco, 419 Rialto Bldg.
Oklahoma City, 205 State National Bank Bldg.

Southwestern Sales Agents:
York Engineering & Supply Company
Houston New Orleans El Paso Fort Worth

Kerr Economy Steam Turbines

And Turbo Driven Apparatus

Send for Bulletins



Kerr Turbine Company
Wellsville, N. Y.

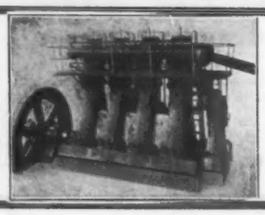
750 Kw. geared Turbo Generator

Green Chain Grate Stokers

For Water Tube and Tubular Boilers

GREEN ENGINEERING CO.
EAST CHICAGO, IND.

Bulletin No. 1—Green Chain Grate Stokers.
Catalog No. 8—GECO Pneumatic Ash Handling Systems
Bulletin No. 2—GECO Steam Jet Ash Conveyors



McINTOSH & SEYMOUR CORPORATION

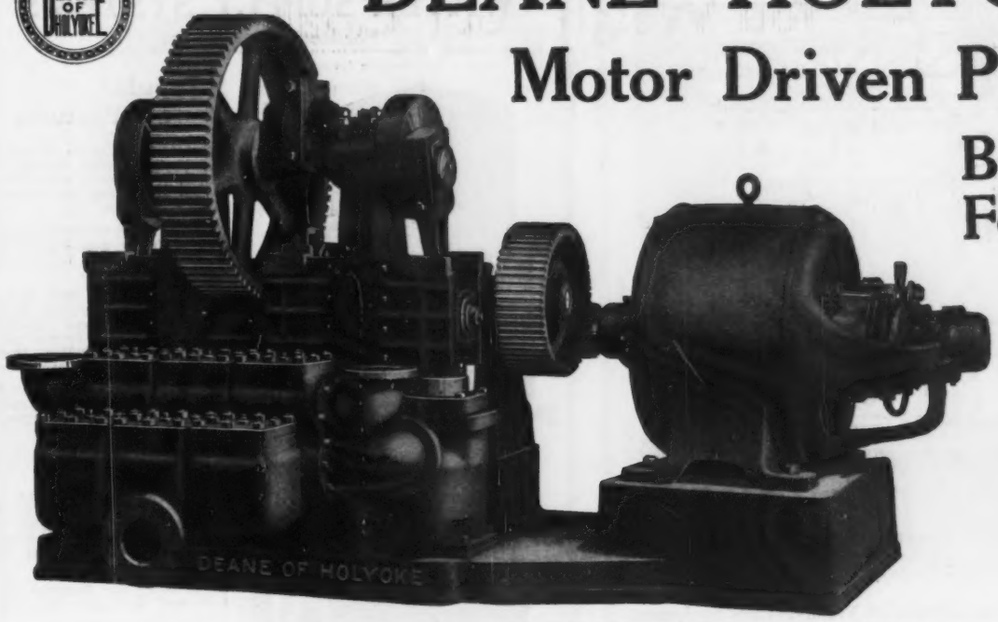
DIESEL TYPE OIL ENGINES AND STEAM ENGINES

AUBURN, N. Y.

DEANE of HOLYOKE

Motor Driven Pumps

Boiler Feeding and General Service



Ask for Bulletin D-204-38

WORTHINGTON PUMP AND MACHINERY CORPORATION
Successor to International Steam Pump Co.
115 Broadway, New York
Deane Steam Pump Plant, Holyoke, Mass.
Branch Offices in all Principal Cities

D 332.4

YOUNG man, 26 years, technical education, 7 years' experience in construction, operation both A. C. and D. C., coal mining operation, wants position as superintendent of small electric plant in South. Salary no object. Box 3852, Elec. World.

"A result getter—

When I need anything more, shall surely use the

SEARCHLIGHT SECTION"

Put your announcement in this "result getter"

Keep All Your Boiler Equipment Earning Money All The Time

Keep your steam producing outfit working at full blast all the time—during ebb as well as peak—by installing a

Carbondale Ice Machine

and outfit. Every Central Station should capitalize its natural advantages as a producer of by-product ice. Learn how others are doing it. Write.

CARBONDALE MACHINE COMPANY
CARBONDALE, PA.
Branch Offices: 50 Church Street, New York; 1013 Manhattan Bl'd'g, Chicago

71063

TRUMP TURBINES

All styles and designs built to suit your location. Send at once for our illustrated catalog.

THE TRUMP MFG. COMPANY
Columbia & Greenmount Aves., Springfield, Ohio

PORTLAND WOOD PIPE

Used in many of the world's largest water-works projects. Made of Oregon or Douglas Fir; in continuous Stave Pipe up to 12 feet inside diam. Also Machine Banded, 2-in. to 24-in. Cannot rust or become incrusted. Stands high pressure and any temperature.

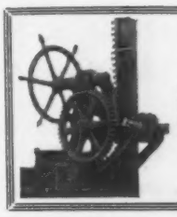
Write for complete information and quotations.

PORTLAND WOOD PIPE CO.
P. O. Box 1183 2 Portland, Oregon

EDGEMOOR IRON CO., EDGEMOOR, DEL.
Boston New York Chicago San Francisco

EDGE MOOR
WATER TUBE BOILER

The Boiler for Class A Service



HEAD GATE HOISTS

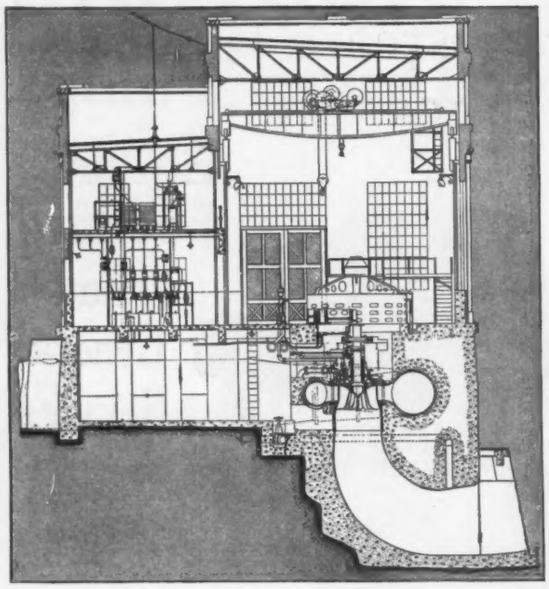
That meet all requirements

We specialize in hand or motor operated Head Gate Hoists of durable design, for gates under any pressure. Illustration shows our Standard No. 5 Hoist. Your inquiries will receive our prompt attention.

Dayton Globe Iron Works
Dayton, Ohio

PLATT IRON WORKS - DAYTON, OHIO.

PLATT



The epoch-making installation of Victor-Francis equipment to produce 50,000 horse power at Cohoes, N. Y.

Bulletins Nos. 619 and 710 describe Victor-Francis equipment.

PLATT IRON WORKS, DAYTON, OHIO

Sales Representatives in Principal Cities

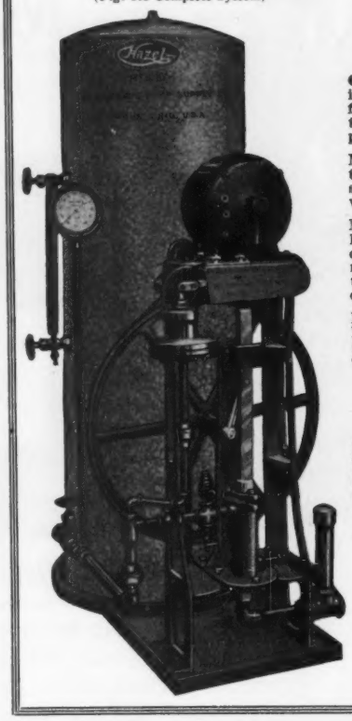
Small Motor-Driven

"HAZEL"

WATER SUPPLY SYSTEMS

For Residence Service

(Fig. 306 Complete System)



Popular Features

COMPLETE — To simplify installations every System is furnished complete, assembled, tested and ready to connect pipes and wires.

NOISELESS — Pump operation perfectly noiseless. Absolutely no gears to become worn and noisy.

MOTOR—Special Type, Overload, ½ H.P. Emerson, made especially for "Hazel" Equipment. Enclosed Frame protects interior winding from damp conditions of basements.

PUMP — All-Brass Fitted, Bronze Bearings. Drop Forged Steel Crank Shaft and Bronze Connecting Rod.

Service

New Business Managers—our Service Department is at your disposal. Sales helps to Dealers and Systems recommended for requirements of consumers.

Write today for Bulletin No. A-18 and Dealers' Discount.

The Columbus Pump Supply Co.

No. 39 West Vine Street

COLUMBUS, OHIO

LE CARBONE—

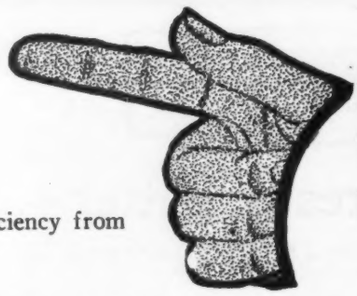
The brush of unvarying quality.

The brush that eliminates commutator wear and trouble.

The brush that gives the longest life.

The brush that enables you to obtain the highest efficiency from your equipment.

NOW is the time to try them.



Here's The Brush You Want

174 FULTON STREET W. J. JEANDRON NEW YORK CITY

Pittsburgh Office: 634 Wabash Bldg.

Canadian Distributors: Lyman Tube & Supply Co., Ltd., Montreal and Toronto

VALVES and FITTINGS

All Sizes for all Purposes

Complete Piping Systems

PITTSBURGH VALVE FOUNDRY & CONSTRUCTION CO.

Pittsburgh, Pa.

HIGH SPEED

ARMATURE NOTCHERS

400 STROKES PER MINUTE

FERRACUTE MCH. CO., BRIDGETON, N. JERSEY, U.S.A.

BRANCHES

Atlanta
Boston
Chicago
Cincinnati
Cleveland
Denver
Havana, Cuba
Los Angeles

THE BABCOCK & WILCOX COMPANY

85 Liberty Street, New York

WATER TUBE BOILERS

Steam Superheaters Mechanical Stokers

BRANCHES

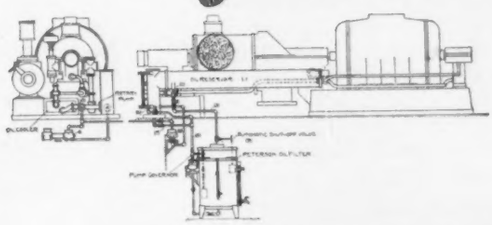
New Orleans
Philadelphia
Pittsburgh
Portland, Ore.
Salt Lake City
San Francisco
Seattle

"Everything For Lubrication But The Lubricants"

What is your steam turbine lubrication costing you?

Steam turbine lubrication requires an enormous amount of oil. To filter it continuously is impractical if the unit is a large one. Not to filter it at all means poor lubrication and compels early oil renewal—a heavy expense. The only practical, economical method is to install the

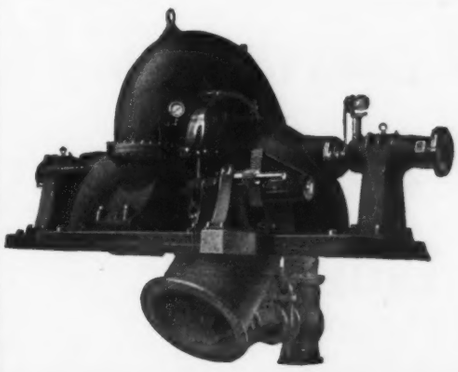
PETERSON SYSTEM OF PARTIAL FILTRATION



It is proving its efficiency and money-saving value in plants that were confronted with just *your problem.* We'd like to show you data on PETERSON performance and explain our system in detail. Bulletin No. L-10 contains the information. *Write for it.*

THE RICHARDSON-PHENIX CO.
LUBRICATION ENGINEERS AND MANUFACTURERS
WORKS-127 RESERVOIR AVE. MILWAUKEE, WIS.

259



SMITH HYDRAULIC TURBINES

ARE KNOWN AND RECOGNIZED THRUOUT THE FIELD OF WATER POWER DEVELOPMENT FOR

HIGH QUALITY SERVICE and ECONOMY of OPERATION

THIS IS THE RESULT OF EXTENDED INVESTIGATION AND THE CAREFUL ANALYSIS OF EVERY FEATURE AFFECTING THE PRACTICAL DESIGN OF TURBINE EQUIPMENT.

WRITE FOR BULLETIN W.

S. MORGAN SMITH CO., YORK, PA.
BOSTON—176 FEDERAL ST. CHICAGO—76 W. MONROE ST.

Bruce-Macbeth
Gas Engines
Cleveland

It will pay every user of power and electric current to look into a private power and light plant. It will surely lower present costs

Send for This Booklet

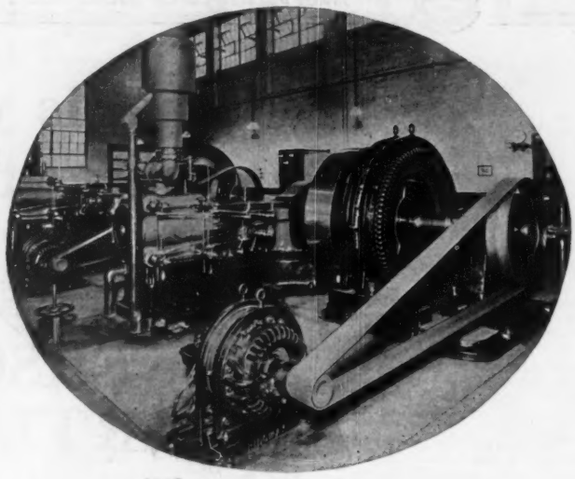
The Bruce Macbeth Engine Co
2182 CENTER ST. N.W.
CLEVELAND

PELTON
-FRANCIS TURBINES
THE PELTON WATER WHEEL CO
2231 Harrison St. — 91 West St.
SAN FRANCISCO — NEW YORK

1

WOODWARD Waterwheel GOVERNORS
Built in All Types and Sizes From the Smallest to the Largest
Woodward Governor Company
206 Mill St. Rockford, Ill.

Where's the Operator?



No engineer, operator, oiler or brushman in sight. Machines running full blast and smooth as clock-work.

"There's a reason"—

RIDGWAY UNITS

Engineers who operate *Ridgway Units* have easy minds. They know their machines and rely on them, and know, too, that Ridgway Units don't have to be coddled and coaxed and nursed with continual adjustments of throttle and field rheostat to take care of every dinky load fluctuation.

Ridgway FLEXIBILITY *does it.*

WRITE FOR BULLETINS

Ridgway Dynamo & Engine Co.

Ridgway, Pa.

The Searchlight Section now Goes to Press

MONDAY MORNING

Get Your Copy in Early

RILEY UNDERFEED STOKERS

The Stoker with the Reciprocating Retort Sides

SANFORD RILEY STOKER CO., LTD.

Worcester, Mass.

Sales inquiries direct to home office, Worcester, or branch offices of B. F. Sturtevant Co., Sales Agents. British Licensees, Erith's Engineering Co., Ltd., London.

D-6

VENTURI METERS

FOR MEASURING HOT AND COLD WATER IN STEAM POWER AND HYDRO-ELECTRIC PLANTS

Send for Bulletin 85-D

BUILDERS IRON FOUNDRY Providence, R. I.

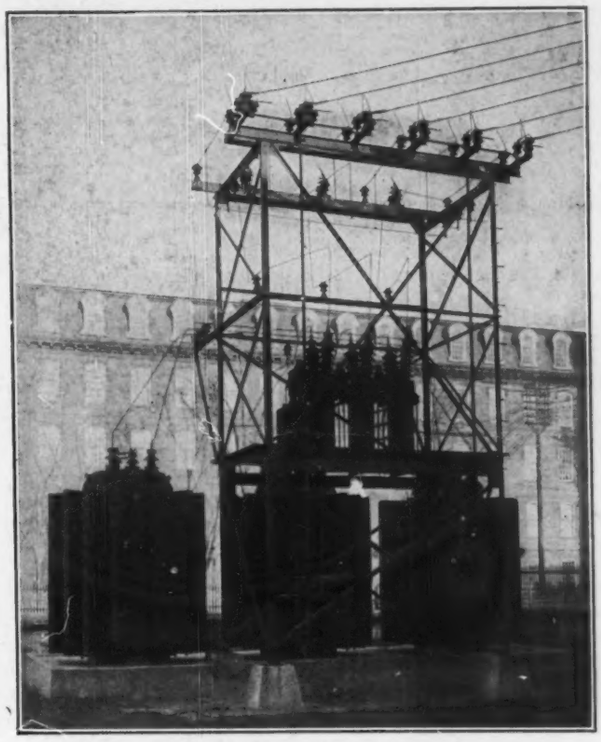
Builders of the Venturi

New York Pittsburgh Chicago San Francisco Los Angeles Portland Seattle Toronto Montreal

BOND ISSUES

should always be advertised in the WORLD as a direct and economical method of reaching the financial people interested in public utility issues who read regularly the ELECTRICAL WORLD for industrial and financial information. All "Proposals," $2.40 an inch.

ELECTRICAL WORLD, 239 West 39th Street, New YORK



6000 Kva. Westinghouse Out-door Radiator-Type Self-Cooling Transformer Sub-Station.

The Low Initial Cost of an Out-door Transformer Sub-Station is Self Evident

The only building construction required, the foundation, is very inexpensive as it rests upon solid ground.

The arrangement is most simple and readily adapted to any local topographical conditions. Westinghouse Radiator-Type, Self-Cooling Transformers have been particularly successful in out-door service—Their electrical efficiency and reliability are matters of record.

A request to our nearest office will bring you many interesting particulars regarding out-door transformer stations.

Westinghouse Electric & Manufacturing Co.

East Pittsburgh, Pa.

Bluefield, W. Va.
Boston, Mass.
*Dallas, Texas
Atlanta, Ga.
Columbus, Ohio
Butte, Mont.
Buffalo, N. Y.
Charleston, W. Va.
Charlotte, N. C.
Chicago, Ill.
Cincinnati, Ohio
Cleveland, Ohio
Baltimore, Md.
Birmingham, Ala.
Dayton, Ohio
Denver, Colo.
Detroit, Mich.
*El Paso, Texas
*Houston, Texas
Indianapolis, Ind.
Joplin, Mo.
Kansas City, Mo.
Louisville, Ky.
Los Angeles, Cal.
Memphis, Tenn.
Milwaukee, Wis.
Minneapolis, Minn.
New Orleans, La.
New York, N. Y.
Omaha, Neb.
Philadelphia, Pa.
Pittsburgh, Pa.
Portland, Ore.
Rochester, N. Y.
St. Louis, Mo.
Salt Lake City, Utah
San Francisco, Cal.
Seattle, Wash.
Syracuse, N. Y.
Toledo, Ohio
Washington, D. C.
*W. E. & M. Co. of Texas.

333

American Electrical Works
PHILLIPSDALE, R. I.

Bare and Insulated Electric Wire
Electric Light and Line Wire
Railway Feeder and Trolley Wire
Galvanized Iron Wire and Strands

NEW YORK OFFICE, : 165 Broadway
CHICAGO OFFICE, - 112 West Adams St.
BOSTON OFFICE, - 176 Federal St.
CINCINNATI OFFICE - Traction Building
MONTREAL

1870 EUGENE F. PHILLIPS 1882 AMERICAN ELECTRICAL WORKS

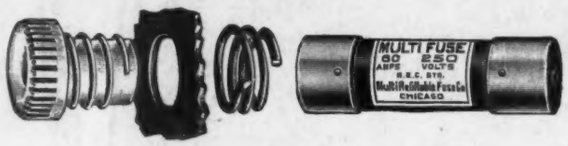
GAUGE BOARDS
Completely Equipped With
FOXBORO
INSTRUMENTS
For
Pressure—Temperature—Speed
Time and Flow
are
Neat—Uniform—Serviceable
Send for Bulletin No. AC-96
THE FOXBORO CO., Foxboro, Mass., U.S.A.
New York Chicago Pittsburgh St. Louis Birmingham San Francisco

For 5/16" to 3/8" Strand

Matthews Giant Boltless Clamp

Installed in less than 3 minutes—five times quicker than a 3-Bolt Clamp. Then, there's the Baby Boltless for ¼" to 5/16" strands. Ask us about our trial proposition.

W. N. Matthews & Bro., Inc., 3727 Forest Pk. Boul., St. Louis
Canadian Distributors, Northern Electric Co., Ltd., Montreal, Halifax, Toronto, Winnipeg, Regina, Calgary, Edmonton, Vancouver.



SPECIFY "MULTI" DEVICES
Multi Clamp Bushings, Multi Soldering Irons, Multi Refillable Fuses, Multi Link Cutouts, Multi Non-Refillable Fuses, Multi Fuse Plugs, Multi Cast Iron Sealable Boxes for Cutouts.
Write for Catalogue and Discounts
MULTI REFILLABLE FUSE CO., 723 Fulton St., Chicago

Bare and Tinned Copper Wire
Magnet Wire, Rubber Covered Wire

Rome Wire Co., Rome, N. Y.

STANDARD

Heat-Resisting Molded Insulation. Made by specialists exclusively devoted to solving your molding problems.

Why not profit by our experience?

HEMMING MFG. CO.
GARFIELD, NEW JERSEY

Jenkins Bros. Hose End Valves

Globe and Angle, are particularly adapted to fire protection service. Jenkins Discs of soft flexible rubber composition form the seat, and make the valves absolutely tight under cold water pressures. The Discs never stick, nor corrode, and valves are at all times ready for instant service.

Jenkins Bros., 80 White Street, New York
Boston Philadelphia Chicago Montreal London
13

Get Your Copy of the New Price Booklet

RAVEN **CORE**

Rubber Covered Wire
Ask for Booklet 23-W
NEW YORK INSULATED WIRE CO., NEW YORK
Agencies and Branches
CHICAGO BOSTON SAN FRANCISCO

The Wear of
"PHONO-ELECTRIC"
Trolley Wire is absolutely uniform throughout its whole diameter. Its life is two and one-half to three times longer than Hard Drawn Copper.

BRIDGEPORT BRASS CO.
Bridgeport, - - Conn.

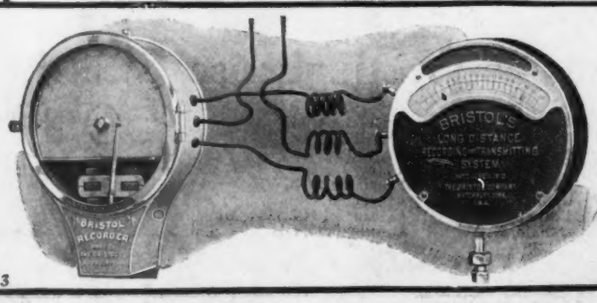
Emerson 5-Year Guarantee Fans

1756

The fans with the 5-year registered factory-to-user guarantee.
Desk, oscillating and ceiling styles shipped promptly from factory or forty wholesalers' stocks.
Prices to the trade only.

The Emerson Electric Mfg. Co.
2032 Washington Ave., St. Louis, Mo.
50 Church St., New York City

TRADE MARK
BRISTOL'S Long Distance
REG. U.S. PAT. OFFICE
Electric Transmitting and Recording System

Although this equipment has been only recently put on the market in commercial form, preliminary models have been in actual service, giving satisfactory results, for more than four years. In brief, this equipment will *indicate* and *record* Pressure, Liquid Level, Temperature, etc., transmitting such indications or records electrically over long distances—30 or 40 miles or even more may intervene between transmitter and recorder.
Fully described in Bulletin No. 192-L.

THE BRISTOL COMPANY, Waterbury, Conn.
Branch Offices: Boston, New York, Chicago, Pittsburgh, San Francisco
3